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RICS COBRA 2012

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Dean Kashiwagi and Kenneth Sullivan

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PREFACE

Dear Conference Participants,

Welcome to COBRA 2012 - the Royal Institution of Chartered Surveyors annual international construction, building, and real estate research conference - hosted by the Arizona State University. The theme of this year's conference is the integration of academia and industry professional, working together to provide solutions, efficiency, and innovation to our industry.

The conference returns to the United States this year and promises to be another successful program. We have 200 papers, a diversity of research and themes, and authors from 32 different countries. This is a true sign of global collaboration of the best researchers, students, and experts. I have been attending the Cobra conference since its inception and have seen it grow. What makes this conference exciting and unique is the following:

- Industry and researcher collaboration
- Law Stream
- RICS workshops and roundtable with panelist
- Particularly high level of PhD Student involvement

The venue of Las Vegas and the Monte Carlo Hotel makes this year's conference especially enjoyable. The atmosphere of the location will provide a memorable experience for all, let us reacquaint ourselves with old friends and help us make new ones. In the last three years COBRA has made stops in Cape Town, South Africa; Paris, France; and Manchester, UK. Las Vegas will continue the tradition of excellent venues.

Every paper within these proceedings was peer reviewed and selected based on the quality of research. I want to take time to thank all the reviewers that made this possible. As the editors we couldn't have done this alone. I would like to give special recognition to those individuals that made this conference possible: Dr. Paul Chynoweth with the University of Salford for the Law Stream/CIB W113, Dr. Charles Egbu and Dr. Kenneth Sullivan for the CIB W117 support, Dr. Monty Sutrisna for the doctoral stream, Dr. Tsunemi Watanabe and Dr. Syed Ahmed for their keynote addresses, and the RICS Team (Jenny and Danielle) for their support. A special thank you to my staff (Ms. Sylvia Romero, Johnny, Catie, and Kailey) that worked countless hours on organizing the papers and the reviews and with the help of our doctoral students (Jacob, Jake, Kristen, Brian, Anthony, and Dhaval); I am very fortunate to have an excellent team and couldn't have done this alone.

Dr. Dean Kashiwagi
Conference Chair
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All papers submitted to COBRA 2012 were subjected to a double-blind review process. Reviewers volunteered their expertise from a multitude of prestigious universities, all representing the innovative contributions made to continuing research and development in the Built Environment education community. The conference organizers wish to extend their gratitude to the following members of the review committee for their efforts to make this publication a success.

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KEYNOTE SPEAKERS

Topic: TOWARD HIGH PERFORMANCE THROUGH COMPETITION IN THE CONSTRUCTION INDUSTRY IN JAPAN

The Japanese construction industry is now making many reform efforts to keep its high performance through enhancing its competitiveness. The objectives of this presentation are to compare essences of public bidding reforms in Japan with principles of the Best Value Approach and to discuss future of public bidding.

Presented by: Dr. Tsunemi Watanabe, Kochi University of Technology (KUT), School of Management

Watanabe received B. Eng. and M. Eng. from Hokkaido University and PhD from the Johns Hopkins University in the field of environmental systems engineering. At the University of Tokyo in 1991, his main research changed to construction management, particularly public bidding. In 1997 at KUT, his focus in education, research, and outreach activities are in the field of construction and local environmental management. He is the current president of Geo Risk Society in Japan, a chairperson of the international alliance subcommittee of the construction management committee of the Japan Society of Civil Engineers (JSCE), and a member of the committee of quality assurance through application and improvement of the comprehensive evaluation method (CEM) in the Ministry of land, Infrastructure, Transport, and Tourism (MLIT).

Topic: HOW CONSTRUCTION MANAGEMENT RESEARCH CAN IMMEDIATELY IMPACT INDUSTRY PRACTICE TO IMPROVE PERFORMANCE AND VALUE

A focus on the global perspective of R&D expenditures in different industries and compare that to R&D expenditure in the Construction industry. Obstacles and bottlenecks in developing a research culture in the academic environment will be highlighted, suggested steps and procedures will be discussed to bridge the gap between academic research and the construction industry needs and requirements.

Presented by: Dr. Syed Ahmed, East Carolina University,
Department of College of Technology and Computer Science

Ahmed is a professor and chair of the Dept. of CM in the College of TCS at ECU.He began his career as a trainee engineer at McDonald Layton and Company in Islamabad, Pakistan. He subsequently held positions at Capital Development Authority in Islamabad, CRSS-AMC Construction Managers in Atlanta, Ga., Georgia Institute of Technology in Atlanta, Hong Kong Polytechnic University in Hong Kong, and at Florida International University in Miami. Ahmed holds a B.S. in civil engineering from the University of Engineering and Technology in Lahore, Pakistan, and M.S. and PhD in civil engineering, majoring in construction management from the Georgia Institute of Technology. He has over 25 years of international experience in teaching, research and consulting in Pakistan, Hong Kong, USA, Mexico, and Jamaica. His areas of interest/expertise are construction scheduling, quality and risk management, project controls, construction safety, construction procurement, and construction education and information technology.

KEYNOTE SPEAKERS

Topic: THE FUTURE OF ACADEMIC RESEARCH

Future research must integrate industry and academia efforts. Academic researchers must be experts. New concepts and technology must be simple, easy to understand, and have dominant value to be able to overcome the resistance to change and absorb the cost of change. Research to change the industry requires visionary industry partners who need and are committed to change and who share the risk and cost of change.

Presented by:
Dean Kashiwagi, Arizona State University,
School of Sustainable Engineering and the Built Environment

Kashiwagi is a professor at Arizona State University's School of Sustainable Engineering and the Built Environment, Director/Creator of PBSRG, and CIB W117 coordinator. He is the renowned world expert in the best value research. His credits include the cration of the IMT, PIPS and PIRMS processes. The technology has been tested over 1000 times totalling $4.7 Billion ($2.9 Billion in construction projects and $1.8 Billion in non-construction projects) with a 98% success rate since 1994. His work has reached beyond the U.S. to the Netherlands, Botswana (Africa) and Malaysia. His is a Fulbright Scholar. Prior to ASU Kashiwagi served in the US Airforce as an Officer Major and Engineer. He is currently a licensed professional engineer in seven states. Also he is an established author in the best value, risk management, performance measurement, and information measurement theory (25 books, 37 journals, and over 160 conference proceedings).

SPECIAL KEYNOTE ADDRESS BY RICS:

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FRICS, Regional Manager, Latin America and the Caribbean
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With 29 years professional experience, Pierce utilizes his background in construction to serve clients in corporate real estate, private property development and the public sector.

RICS PANELISTS

Moderator: Simon Taylor, CEO
Questant Inc.
Taylor has over 25 years of international project consultancy experience at a senior level. Taylor also teaches Construction Management and Computer Applications at Pratt University in New York, and is a former chair of RICS Americas, and continues to chair the Project Controls and Construction Management professional group in the Americas.

Jeff D. Baize, CEO
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Baize is the Founder and CEO of Brookhurst Development Corporation, a national development firm that specializes in public-private partnerships ("P3s") since 1996. He has written numerous articles, including School Facilities Planning: A Guide to Laws and Procedures for Funding, Siting, Design and Construction (Solano Press) wherein he authored the section on public school development using private funding. Baize holds a Bachelor of Architecture and MBA degrees, both conferred at the University of Texas where he was also a faculty member teaching real estate development and finance.

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Faithful+Gould's PPP Technical Advisory
Brady is a Regional Commercial Director for the Faithful+Gould's PPP Technical Advisory practice for North America. He has provided services on PPPs including technical due diligence, commercial and risk advisory, Independent Certifier, construction monitoring and program management to Lenders, Public Governments and Investors for multiple projects in North America and Europe. Brady worked extensively on PPP and Private Finance Initiative projects throughout England, Scotland and Ireland in technical advisory roles for new projects and in transaction advisory roles for secondary market acquisitions. He holds a BA from Northern Arizona University and an MBA from Arizona State University.

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Pearlman is a founding partner of the law firm Inglesino, Pearlman, Wyciskala & Taylor, LLC, of Parsippany, New Jersey. In his quarter century of practicing law, Pearlman has closed over $10 billion par amount of financings, primarily in the areas of public, project, redevelopment, and renewable energy finance. He has acted as bond counsel, as well as transaction, underwriters', finance, project, and borrower's counsel over that term. Several pieces of New Jersey legislation have been drafted by Pearlman and enacted by the State Legislature, resulting in either expanded financing opportunities, and/or cost savings initiatives for local government.

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Communication skills in ADR: Theory adding value

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Abstract:
Communication is an essential element in the negotiation process. The fast and competitive nature of the construction industry lends itself to reliance on inherent communication skills for the facilitation of mediation and conciliation. The questions raised; are inherent communication skills sufficient to support effective negotiation; and is there a need to be familiar with the theoretical aspects of communication?
The purpose of the study is to identify the essential elements required by facilitators which may enhance effective communication. The requirements for effective communication based on standard international practice were sourced from literature, studied and applied to the South African Construction industry to identify which skills and attributes would provide the most support. Based on the findings of the literature review, a survey questionnaire was developed and distributed amongst practicing professionals and their staff/employees who are active in the industry with the view to determine the levels of the respondent's knowledge and skills relating to the identified elements and how they rate the importance of these skills and attributes to success in their practice. The research findings suggest that effective communication in mediation and conciliation will lead to more generally acceptable outcomes when the parties consider the process to have been fair and well facilitated.

Keywords:
ADR, communication, learned, requirements, theory.

1 Introduction

Communication is a primary element in the negotiation process. Brown and Marriott (1993) are of the opinion that in the past, negotiation training has not been an integral part of the education and training of professionals who have had to develop these skills and attributes on the job. This trend is starting to change and that there is an increased demand for formalised development in this regard.

Curriculums of tertiary institutions are generally saturated with subject matter pertaining to the technical and management sciences, with limited time available for the development of the "softer skills" such as communication. Some tertiary institutions address the ADR context in their curriculums in modules such as Construction Contracts Law and Professional Practice (Du Preez and Verster, 2011).

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According to Brown & Marriott, (1993) communication and negotiation skills are largely influenced by personalities within the workplace and facilitators may tend to emulate their formal mentors;
According to Povey, Cattell and Michell (2006), professionals in the industry are inclined to place more emphasis on the evaluative skills of ADR than facilitation skills which promote effective negotiations.

Research conducted by Povey (2005) supports the notion that professionals rely on their inherent communication skills to facilitate mediation. This reassesses the question as to whether or not inherent communication skills are in fact sufficient to support effective negotiations; or is there a need for further education and training in the theoretical aspects of effective communication?

According to Boulle and Rycroft (1997) and Brown and Marriott (1993) referring to standard practice of mediation, mediators require a range of skills and techniques which support the applicable functions however; these skills are inherent, learned, and intuitive; or may be acquired and developed through education, training and experience. Some consider communication to be a natural or inherent skill however; Knipe, van der Walt, van Nierkerk, Burger & Nell, (2002) support the belief that communication can also be learned.

2 Negotiation

Negotiation presents itself as a method of ADR and it is also an important skill required by facilitators in order to achieve competence in all consensual methods of ADR.
According to Richbell (2008), successful negotiations require effective communication between the parties and the facilitator who ensures that the message is conveyed and received in an effective manner.
Pretorius (1993) suggests that a thorough understanding of the principles and techniques of negotiation is considered an advantage to those who facilitate ADR.
Due to limited education in negotiation skills, relatively little is known about the science and art of the subject (Pretorius, 1993). In support of this opinion, Bevan (1992) suggests that some professionals such as lawyers are self-taught however, basic theory of communication skills, attributes and processes may add value to competence in facilitation

3 Communication

De Wet (1991: 1) suggests that communication is the imparting of ideas to achieve a mutual understanding. However, in ADR messages are often interpreted by the receiver from an emotional perspective which further emphasises the need for effective communication and listening skills. This is where the skill of effective communication may have its greatest impact in the mediation process which is combined with the facilitative procedure of conciliation.
Moore (1986) is of the opinion that the extent, structure and quality of communication contribute to the successful outcomes of negotiation and as with most negotiations, communication is the central component in the negotiation process upon which, good communication skills support constructive negotiations.

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The above discussions suggest that the quality of communication is dependent on the participants and facilitators and as such, communication is identified as an important skill in achieving successful negotiations. As such, the facilitator who has a good theoretical knowledge of communication skills and the application in ADR would in all probability apply this knowledge in the execution of their facilitation roles and in so doing, promote effective negotiations.

Communication is an important element in Project Management and has been identified as a Knowledge Area in the Project Management Body of Knowledge (PMBOK) (2008) however, the probability exists that communication management failure may lead to disputes (Boulle & Rycroft, 1997).

As illustrated in Figure 1, conflict invariably stems from poor communication and may inhibit the negotiation process. Ineffective communication may lead to a breakdown in the negotiation process which may result in a deadlock. This may create a challenge for the mediator who may need to creatively restructure communication to encourage the pursuit of negotiations. Poor communication skills create a negative cycle in which disputes are difficult to resolve (Richbell, 2008; Boulle & Rycroft 1997; Moore, 1986). Ineffective communication may cause a dispute to worsen and the facilitator may need to apply good communication skills in order to restore constructive communication channels (Boulle & Rycroft, 1997).

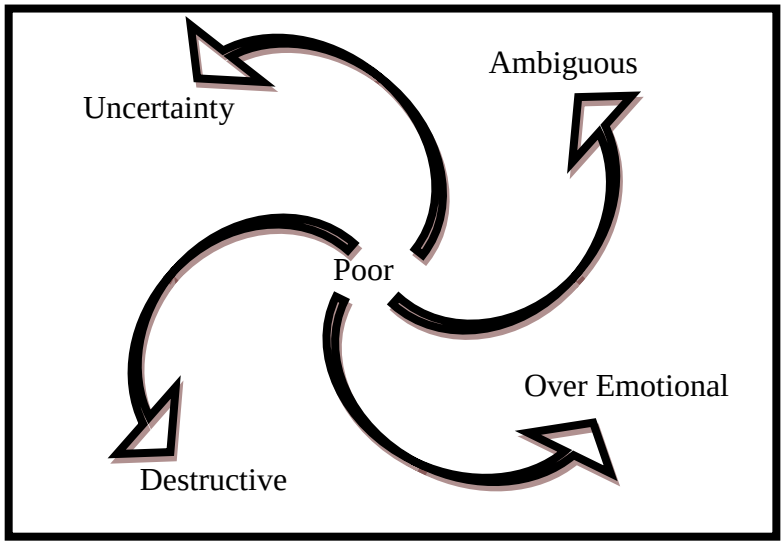

Figure 1: Unproductive communication
(Source:Adapted from: Boulle & Rycroft, 1997)

A theoretical knowledge of communication in ADR may assist in identifying the problem areas in order to restore effective communication. As illustrated in Figure 2, a positive approach should continue producing outcomes for effective mediation.

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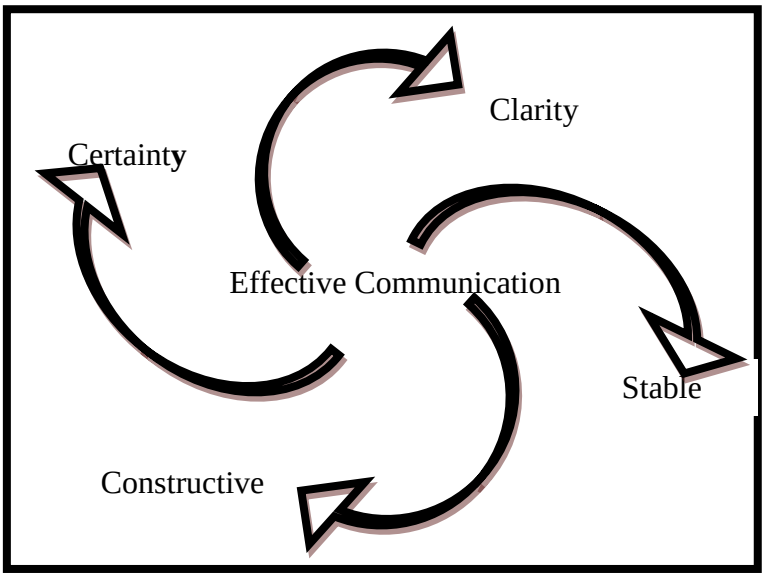

Figure 2: Productive communication
(Source:Adapted from: Boulle & Rycroft, 1997)

The question is raised as to the extent to which these communication skills are natural, inherent, learned or acquired by experience?

3.1 Active listening

In order to receive and convey the message without distorting it, the facilitator would be required to be an active listener (Moore, 1986). Active listening supports effective communication which assists parties to better hear and understand a communiqué (Brown & Marriott, 1993).

Active listening is an important element in effective communication and it is a skill which is progressively developed and is used as a tool by facilitators to identify the emotional status of the parties. It is an essential component in the communication process whereby the receiver of the communiqué listens attentively in order to analyse the conveyor's emotions in the message and to reiterate the message for confirmation (Moore, 1986).

Active listening underlies the communication process in ADR of which the facilitator requires a good understanding. Active listening is a skill which is vital to the communication process and addresses various important factors inter alia:

- Parties speak without interruptions to allow full explanation of their dispute and expressing emotions.
- Parties are assured that they have been heard.
- Emphasis on the individual demonstrates the acceptability of expression and develops a better understanding of the concerns based on both the verbal and non-verbal message.
- Helps the speaker to identify his/her own emotions.

- The mediator can better understand, summarize and analyse the parties' concerns.
- Creates a situation where the facilitator can absorb the message, verify and integrate it into an extension of the negotiation process. (Boulle & Rycroft 1997: 153-154; Brown & Marriott, 1993; Moore, 1986).

In view of the above, the facilitator may therefore need to be aware of the parties' capabilities of absorbing the messages because a distraught disposition may hamper a person's ability to actively listen.

The objective of active listening in the negotiation process is to create a mutual understanding by clarifying uncertainties, summarising facts, concerns and feelings, acknowledging the message and reiterating to facilitate a better understanding of concerns, feelings and emotions. By displaying an understanding of the parties' feelings and emotions and receipt of the facts, may assure parties that a concerted effort is being made to resolve the dispute (Boulle & Rycroft, 1997; Brown & Marriott, 1993, & Moore, 1986:).
Figure 3 below illustrates the extent of the skills and attributes required for the effective application of active listening.

REQUIREMENTS FOR ACTIVE LISTENING

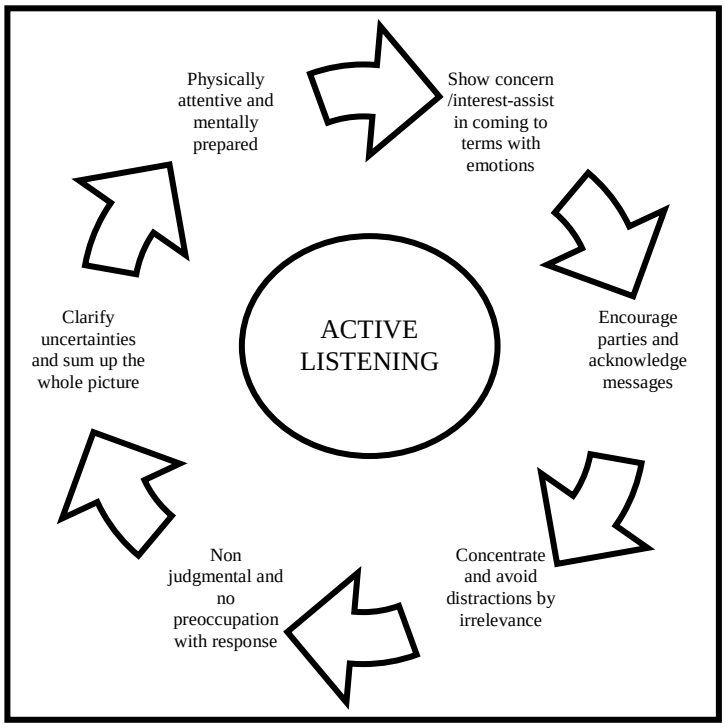

Figure 3: Requirements for active listening
Source: Adapted from: (Moore, 1986; Boulle & Rycroft, 1997).

Boulle and Rycroft (1997) suggest that there are three categories of skills which promote active listening which assures the parties in the negotiation process:

- Physical attention is displayed by interest and encouragement where face-to-face, relaxed and direct eye contact is suggested.
- A display of full comprehension is noted by minimal encouragement, occasional questions, reframing and summarizing notes.
- Reflecting and summarizing the whole picture.

In addition to active listening, communication in ADR is supported by various elements pertaining to the psychological element addressed in facilitation. The intention is to prepare the parties psychologically for the evaluative part of mediation. Considering the extent of the skill of active listening relating to effective communication, practicing professionals may need to be familiar with the theory to support effective application.

3.2 Paralanguage

Paralanguage refers to the "tones" or "effects" used to emphasize messages. Awareness of these effects will assist the mediator to better assess the mood (Boulle and Rycroft, 1997; De Wet, 1991,). Paralanguage may be less complicated to identify however; it may pose a challenge to address, especially in an emotional situation.

The identification of the psychological state of the parties may assist the mediator in directing negotiations to suit the mood of the negotiators. The approach to the negotiations may need to be adjusted as the mood changes. Apart from being aware of the paralanguage of the disputing parties, the mediators may consider managing their own (Bevan, 1992).

3.3 Non-verbal communication

"The most important thing in communication is to hear what isn't being said" (Drucker, 2001).

In addition to paralanguage, the skill of identifying non-verbal communication was considered important in achieving competence in the facilitation of ADR in so far as the emotional state of the parties can be detected and according to De Wet (1991), non-verbal messages may contradict, complement or accentuate verbal messages. As a form of self improvement, it is preferred that non-verbal messages complement verbal messages.
As with verbal messages, body language should also be used appropriately and in a positive sense bearing in mind that body language varies between different cultures (Boulle and Rycroft, 1997).

Non-verbal communication can be used to send both positive and negative messages and the facilitator would do well to recognize and appropriately react to these non-verbal messages. The identification of non-verbal messages plays an important role in communication. These messages can portray the parties underlying feelings such as status, anxiety or lack of confidence. In addition to this, it can be used to threaten, show authority or even show encouragement (Boulle and Rycroft, 1997; Brown and Marriott, 1993 and Moore, 1986).

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It is important that the facilitator be alert to these non-verbal messages however; the mediator should also be conscious of his/her own non-verbal messages so as to be perceived by the parties to have an unbiased and positive attitude As the mediator would be observant to identify the body language of the parties, careful consideration should be given not to display any feelings such as irritation or impatience in the form of body language (Boulle and Rycroft:1997).

3.4 Being silent

As with verbal and non-verbal communication, being silent represents a form of communication. Boulle and Rycroft (1997) and Brown and Marriott (1993) suggest that silence can be manipulative to those who may be uncomfortable with it. In a situation such as this, the uncomfortable party may be forced into a decision. However, in the positive sense this may provide the moment of silence to reflect and the parties may consider propositions. Being silent was identified as a technique used by facilitators in a positive sense however, the negative application may need to be identified.

4 Attributes

Attributes were identified as being essential elements relating to effective application of facilitator skills and professionals may find that being aware of these assists in the art of the application.

Some may find that they are naturally equipped with inherent qualities which are considered an asset in the application of facilitation skills however; these qualities have to be demonstrated by the facilitator and are referred to as attributes and are generally known as ‘soft’ skills.
According to the Oxford English Dictionary, (2002) an attribute defined is a “characteristic quality”; a distinct feature which makes a person different from others. Authors (Brown and Marriott, 1993 and Boulle and Rycroft, 1997) are of the opinion that attributes may be learned and developed with experience however, Bevan (1992) bases his identification of the attributes on personality types.

Brown and Marriott (1993) suggest that attributes relate to psychological and personality traits whereas the Oxford English Dictionary (2002) defines psychological traits as the mental characteristics or the attitude of a person. Characters may therefore be formed and influenced by an individual’s surroundings however; attributes may be generally learned and developed though practice and experience.

4.1 Impartiality

Boule and Rycroft (1997) believe impartiality relates to even-handedness, objectivity and fairness to the parties during the dispute. Finsen (2005) suggests that although under obligation, it is a matter of professional honour for the principal agent to be fair and impartial to both parties. In view of these requirements, impartiality may be learned or developed with experience.

4.2 Empathy

Empathy reflects an awareness and respect for the parties' concerns (Brown and Marriott, 1993). Empathy refers to comprehension by the facilitator has on the thoughts, perceptions and feelings of the parties and responding to them in a sympathetic way (Boulle and Rycroft, 1997). Butler and Finsen (1993) are of the opinion that empathy would encourage the parties to respond and explain their situation better however; this should be applied in an even-handed manner.

5 Discussion

Active listening goes beyond merely audibly receiving a message in order to conveying it; it develops an understanding of each other's views and intentions. Boule and Rycroft (1997) are of the opinion that the ability to listen is not just a passive exercise. Although listening skills can be learned, the inherent ability to listen actively may add value to the active listening process.

Due to the rarity of being gifted with inherent communication skills, theoretical communication skills are required by facilitating practitioners Furthermore, people may be inclined to overestimate the extent of their skills when doing a self evaluation. Practitioners who have limited practice in communication skills may lack the natural inherent skills, would in all probability benefit form a better theoretical knowledge to support effective communications.

Povey (2005) indicates that mediators in the South African Construction industry are inclined to unilaterally resolve a dispute for the parties, which suggests that success rates in mediation are not in essence related to effective facilitation and communication skills as reflected in the study.

Although practitioners are inclined to rely on their inherent negotiation and communication skills when facilitating ADR, the application of various personal attributes which relate to ADR practitioners may add value if considered, developed and applied effectively. As such, a theoretical knowledge may assist the effective application when facilitating.

6 Research Methodology

A literature review was conducted to identify the requirements for effective communication based on international standard practice of ADR, followed by a mixed method study which employed self-response questionnaires to determine the level of the practioners' theoretical knowledge relating to communication in ADR practice in the South African construction industry. One hundred questionnaires were distributed with a twenty eight per cent response. Respondents were requested to rate the importance of and their knowledge, skills and attributes relating to communication in ADR. Experience was rated according to the number of actual interventions.

Quantitative measures were used to determine the respondents' level of importance, knowledge and skill relating to the various attributes in the form of self assessment questions whereupon qualitative data was collected and through the process of triangulation, was used to verify the findings of the research, upon which the present situation in the construction industry was recorded. Qualitative data was used to identify the current situation in the industry.

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The results of the questionnaire analysis were illustrated in graphical format comparing the relevant elements relating to the required theoretical knowledge.
Due to the extent of the target population of architects, engineers, quantity surveyors and construction project managers, the sample group was limited to professionals who currently manage or are employed in practices in the Construction industry. In addition to this, the responses were grouped as follows: 30 years, 30-40 years and over 40 years. This was to identify the areas of knowledge received.
The net effect of the sampling strategy is that the findings of the study will not be able to be generalized to the entire South African Construction industry, but will serve as a means of identifying areas for future research.

7 Findings

Respondents were generally of the opinion that they applied communication skills in ADR without giving it much thought, thus suggesting that they are equipped with the application requirements in the form of inherent skills and attributes. The respondents rated themselves very high in regard to their knowledge, skills and attributes in communication and negotiation of which communication is a primary element. The knowledge levels are rated above 70% with skills and attributes slightly lower. Negotiation is generally rated lower than communication in spite of communication forming the main function of negotiation.

Figure 4 is a graphical presentation of the respondents' skills relating to the effective application of communication upon which active listening was rated as being very important above 90%.

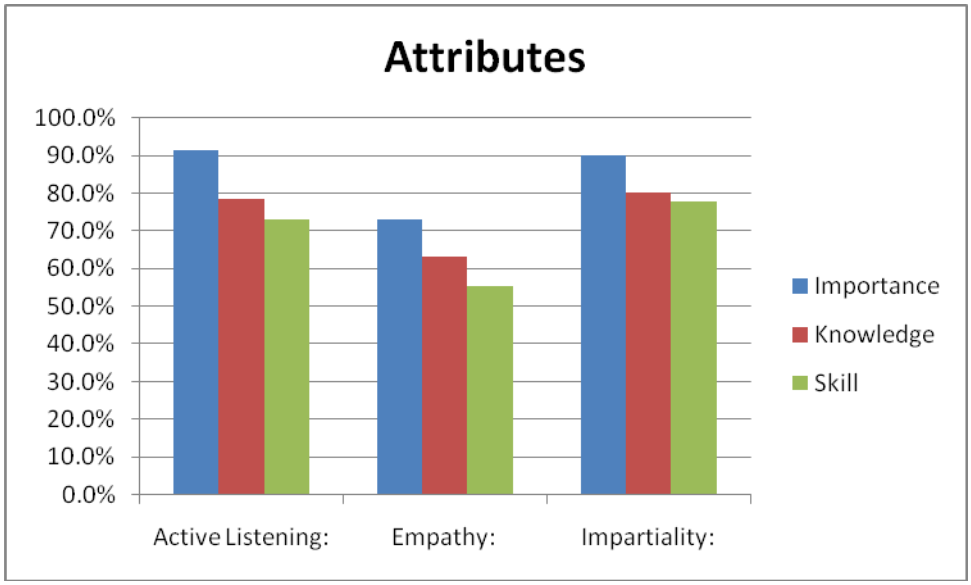

Figure 4: Respondents'analysis of the importance, knowledge and skills of the attributes. Source: Author's diagram

At a glance, the illustrated findings of the research suggest that professionals in the Construction industry consider the relevant attributes and skills supporting communication to be important and have assessed themselves to be knowledgable of

and skilled in the requirements for effective application however, the findings of the quantitative resarch does not correllate with that of the qualitative research. In spite of the escalated self analysis which suggests the probability of response bias, the lack of theoretical knowledge was displayed in the literature review and interviews. Secondary data indicates that tertiary institutions do not include an in depth study of the ADR skills and attributes in their curriculums, suggesting that the escalated self analysis is based on perceived inherent qualities.

An interviewee, an architect by profession, was of the opinion that few people have the skills to resolve a dispute within minutes of walking into a room. This suggests that effective communication skills and supporting attributes are rarely inherent but rather developed over time.

Based on the findings of the qualitative research, respondents are of the opinion that there is a need for education and training in communication skills and attributes for effective application of ADR. Furthermore, understanding and empathy is regarded as a "waste of time because we are running a business". There was generally a lack of regard as to the importance of empathy in the application of communication skills and this was also reflected in the quantitive analysis.

The results of the age group analysis are reflected in Table 1 below. It is interesting to note that empathy correlates with the qualitative research to a certain degree

Table 1. Results of the age group analysis (%)
(Source: Author's own table)

	Knowledge			**Skill**			**Attributes**			**Experience**		
	< 30	**30-40**	**40 >**	**< 30**	**30-40**	**40 >**	**< 30**	**30-40**	**40 >**	**< 30**	**30-40**	**40 >**
Communication	63	86.7	78.6	63.3	63.3	72.9	60.3	66.7	76	50	53.3	62.9
Negotiation	63	73.3	78.6	53.3	56.7	68.6	53.3	73.3	71	47	50	60
	Importance			**Knowledge**			**Skills**			**Experience**		
Active listening	80	100	92.9	63.3	86.7	81.4	60	80	76	40	43.3	67.1
Empathy	53	76.7	80	40	76.7	67.1	30	66.7	61	27	40	60
Impartiality	77	96.7	92.9	63.3	80	87.1	66.7	83.3	80	37	43.3	70

The additional analysis where responses were divided into age groups is a clear indication of the reponse bias in so far as experience in the skills and attributes is rated somewhat lower than that of knowledge and skills. Although respondents are aware of the importance of communication skills, experience is somewhat lacking.It is interesting to note that the 30-40 year age group have higher knowledge ratings than the under 30 and over 40 year groups.

8 Conclusion

Respondents assessed themselves to be knowledgable and skilled in both communication and negotiation including the attributes relating to the effecive application of ADR. The graphical presentation of the results of the quantitative data relating to the effective application of communication in ADR in the construction industry suggests that the response was not reliable in relation to the qualitative data gathered from the findings of the literature review and the interviews conducted.

In spite of the probability of response bias, the qualitative research indicated that there is a need for increased emphasis to be placed on the importance of the theoretical knowledge relating to communication in ADR, which professionals may refer to in the process of gaining experience on the job.

Based on the architect's opinion addressed in the findings, it is suggested that the industry should not be totally reliant on inherent communication skills but rather that these skills should be developed though formal training and development programmes.

8 Recommendations

It is recommended that professionals in the Construction industry take heed not to underestimate the importance of a sound theoretical knowledge of communication skills in the application of ADR.
It is further recommended that based on the importance of the communication skills in ADR practice, tertiary institutions consider including communication skills in their curriculums.
Institutions should provide opportunities for professionals in the industry to update their knowledge of communication skills in the form of Continuous Professional Development and that emphasis should be placed on the advantages of the theoretical knowledge.

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Complex Multiple Party Disputes: Throw Out the Standard Mediation Model

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Abstract:
Mediation of complex construction disputes that involve multiple issues (whether multiple changes, claims, disputes, delays, or defects) may include the Owner, Prime Contractor, Multiple Subcontractors, Suppliers, Architects, and Engineers. Each of these parties may have Attorneys, Experts, and Insurance or Surety Claim Adjusters who will be involved in the mediation. These types of disputes require that the standard mediation model of a pre-mediation exchange of positions, joint session, and then caucus sessions with all parties present be changed. The success of complex, multiple party construction disputes requires that the Mediator begin mediation before any joint session, if a joint session is ever convened. Complex multiple party mediation process is actually more cost effective when the Mediator is able to meet with each of the parties individually or in combination with other parties throughout the mediation process without allowing other parties to sit and wait idle in caucus rooms. This allows the Mediator to find common party interests and needs, where there are champions to help the cause, and where the key divergent positions and personalities may lie in a more controlled, efficient, and cost effective manner.

1 Introduction

Much of the literature discussing multi-party mediation of complex disputes stems from the mediation of international nation disputes including Bosnia in 1994 and several regional conflicts in Africa (Angola and Liberia) and South America. The lessons learned from these international conflicts now being applied throughout the mediation community include concepts of "leverage" and understanding similar alignments with conflicting agendas. Leverage is the concept of finding coalitions and groups that can be aligned to provide weight to move the mediation process towards resolution. The concept of conflicting agendas arises when multiple parties may have similar but not identical alignments commonly found in multiple party negotiations. Additionally, due to the number of parties, alignment of interests, and trust issues from years of war, border, and territory disputes, teams of Mediators worked together depending on the parties and issues being discussed. Complex multi-party mediation in the commercial

and construction dispute areas are likewise now starting to use Co-Mediators for specific issues or parties involved in the conflict.

Mediation has evolved from a two party dispute resolution mechanism to one involving multiple parties, aligned interests with possible conflicting agendas, use of leverage, and use of Co-Mediators. These changes in the mediation process are reasons why a Mediator in a multi-party construction dispute must change the typical mediation process template to adapt to the needs of complex multi-party mediation.

2 Traditional Mediation Rules

When considering the level of sophistication in multi-party mediation, it should be noted that while mediation rules and procedures allow for a flexible process, little guidance is given on how to modify a mediation when multiple parties are involved. Ultimately, the procedure is left up to the skill and creativity of the Mediator and parties to devise a process to fit the needs of the mediation (AAA, FINRA, JAMS, NAR, and WIPA).

It is critical that the Mediator of a multi-party complex mediation take control of the process, the parties, and the attorneys. This does not mean that the overall process cannot remain flexible and adapt to the needs of a particular dispute. However, multi-party mediations require additional time to prepare and develop the negotiation issues, may require multiple mini-mediations within the mediation, may require assistance with Co-Mediators, and may need time to find leverage alliances with parties. The Mediator needs to manage these dynamics and not succumb to the varied interests and desires of the participants who think they have a better way to run the mediation.

3 Developing Techniques To Handle Multi-Party Mediations

As noted above, the Mediator's first task is to understand that controlling the process is critical. Scheduling, management, organization, and clear agreements for the process must be the Mediator's priority.

It is also important for the Mediator to assess who may be aligned, who may become champions and can provide leverage to assist in moving the process to settlement. Similarly, the Mediator needs to assess who will be negative influences or seek to avoid the process and the conflict. Managing negative influencers is critical to obtaining a successful outcome, and is a key reason the Mediator must rely on leverage, alignments, and champions to assist in the process. Further, depending on these multi-party dynamics the lead Mediator may seek Co-Mediator assistance. As discussed below, Co-Mediation can be beneficial to a mediation when the mediation involves different personalities, skills, technical issues, and cultures.

Multi-party mediation is a process that can cause a significant amount of wasted time if parties, attorneys, and experts are waiting for their turn to speak with the Mediator. The wasted time generates mistrust and a frustration that significant fees are being incurred without progress to a settlement (even if progress is being made overall with the other participants towards resolution). Process control and management must continue throughout the mediation.

Getting the parties into the same ballpark for the mediation defines the out of bounds and the playing field for the mediation. The more parties there are to a mediation the more opinions exist for what each party desires in a settlement and where they think settlement and contribution should lie. As a result, it is sometimes helpful to have the participants define the boundaries of the dispute playing field and continue to re-define and narrow the field for settlement as the mediation proceeds.

4 Initial Pre-Mediation Conference

Typically, a Mediator conducts a pre-mediation conference to introduce him/herself, calendar the mediation session and location, and discuss the schedule for submittal of pre-mediation statements without substantive discussion into negotiation.

While establishing a rapport with the participants and building a level of trust is imperative for the mediation process, with multi-parties and complex issues, the initial trust building takes more time. Used wisely, the initial pre-mediation conference and time before any joint session is held can be used so that the Mediator can begin to build trust, understand the dispute, and sense the interpersonal dynamics that may be involved.

The Mediator should ask the participants to briefly explain the dispute, how they each relate to the dispute, and what the parties' perspective is regarding the dispute. This overview allows the Mediator to immediately start gaining a better understanding of the overall dispute, the issues that may be involved, and to start appreciating the interpersonal dynamics to leverage relationships. It also allows the parties to start building the trust relationship with the Mediator. Finally, it allows each party to speak and be heard by the others so that everyone listens to each other's reality of the conflict.

Depending on the dispute and comments made in the pre-mediation conference, the Mediator can begin discussion of a mediation schedule. It may be prudent for the Mediator to first conference with each participant separately, and then reconvene for another pre-mediation conference to set the mediation schedule. This allows the Mediator to build relationships with the participants individually, gain a deeper understanding of the issues in conflict, formulate leverage alignments in the conflict, and determine if Co-Mediators would be beneficial.

5 The Scheduling Conference

The scheduling conference is when the Mediator is ready to set the joint session and initial caucus sessions, now understanding the dynamics of the conflict. The conference will establish the schedule and content for exchange of mediation statements (including confidential Mediator eyes only statements).

This conference is important for the Mediator to take control of the process by establishing how the joint session will be conducted, including who shall attend, and the time schedule for the joint session. It should be clearly expressed what will occur and what the goal(s) of the joint session is/are through party presentations and in consensus development of the conflict issues that need to be addressed.

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The Mediator should also schedule the first rounds of caucus sessions based upon the initial pre-mediation conference call and individual party meetings, identifying the parties or groups of parties that the Mediator desires to speak with first. By only scheduling necessary parties for each caucus session, wasted and unproductive time can be minimized. Further, the logistics of having numerous meeting and caucus rooms is eased.

As alluded to by Crocker, Hampson, and Aall, control of the process is needed to "herd the cats," to control the masses and move them in a somewhat organized fashion into the mediation process (Crocker, et.al. 1999 and 2001). Shaping the process and establishing clear rules and boundaries of the initial stages of the mediation set the tone of how the overall mediation will proceed.

The simple act of carefully planning the mediation process, initial schedule, setting rules for the joint session, and organizing the opening rounds of caucus sessions sets a framework of control and trust that the Mediator is ready and able to move the process to resolution. And, this is before any negotiation or issue development has even taken place.

6 Joint Session Consideration

When scheduling the date and location for the preliminary joint session, consideration should be given to scheduling the order and length of time for each presentation. Some Mediators may feel that joint sessions are not needed and would rather proceed directly to caucus and negotiation. However, a joint session is important to let the parties have a safe environment to each provide their perspective on the dispute issues. The presentations can be cathartic and open dialog. They can also be emotional and appear to take the mediation steps backward from settlement (but necessary to move forward). It is important that parties have an opportunity to speak and be heard regarding the dispute and what their perspective is; not just to the Mediator but to the other participants.

7 Joint Session Opening Statements And Consensus Building

The joint session of a multi-party/complex dispute mediation is a time for the parties to describe their reality of the dispute to the Mediator and to the other participants. The time needed for presentations is obviously longer with multi-party/complex dispute joint sessions; hence the need when scheduling the preliminary joint session to set the order and length of time for each presentation. In fact, depending on the number of parties and complexity of the issues in dispute, the Mediator may devote the entire joint session to only opening statements and the consensus building on what issues need to be discussed and resolved to settle the dispute.

Again, it is important that the Mediator maintain control of the process. The Mediator needs to acknowledge the parties and their positions, while explaining that the parties' differences can either allow them to agree or agree to disagree. The key question that the parties need to answer after opening statements is whether they are committed to working to a resolution despite the differences between them. If they would rather agree to disagree, the parties need to understand that at mediation they have the opportunity to

shape the resolution. To agree to disagree, and continue towards litigation requires that they all weigh the risks of proceeding to trial and forfeiting the opportunity of a reasonable negotiation.

Setting the tone at the preliminary joint session also requires that the Mediator begin changing any preconceived settlement expectation of "what I want" to "what I need" or "what is reasonable" to resolve the dispute. A flipchart or whiteboard allows the Mediator to have a place and a time to list, prioritize or frame issues and groups of issues with dialog and open communication from the participants. This subtle technique of writing allows time for the parties to talk about the dispute and issues; it opens communication, which is most likely something that has broken down as a result of the dispute. Getting the parties to identify key issues begins the process of communicating with each other and the Mediator to move the dialog towards settlement discussions and what might be reasonable terms and issues to reach settlement.

The preliminary joint session is critical. It is a time when communication lines are re-opened and the participants can begin to understand why it is that other parties see the dispute differently. By the end of the joint session, the Mediator should have identified not only the issues involved in the dispute that will need to be discussed, but also have confirmed the follow-on sessions. These sessions should be arranged to meet with common alliances, those with common issues, and those where the Mediator can begin to work with the parties with leverage towards a settlement. An example may be seen in a construction dispute involving an owner, prime contractor, and multiple subcontractors. It may be necessary to meet with all the subcontractors as a common alliance. Maybe meeting with the owner and prime contractor will allow for a settlement that the prime contractor can then take back to the group of subcontractors. Again, the preliminary joint session and dialog allows the Mediator to appreciate the dynamics of the dispute and where to form bargaining positions.

As the joint session begins the process of communicating and framing the dispute from the perspectives of the participants, a good technique to use is to also frame the dispute in terms of settlement ranges. Some might think it is much too early to discuss settlement ranges. However, the transition from "what I want" to "what is a reasonable settlement" needs to take place. Obtaining a dispute range helps the parties to think about the "reasonable settlement" range and continues to build consensus before actual settlement offers are exchanged. A suggested technique is the use of polling / ballots.

8 Polling / Ballots

The use of ballots during mediation and with different groups/participants can be a very helpful tool to obtain input from the participants, while at the same time letting each party understand where the collective wisdom lies (Kichaven 2008). At the preliminary joint session, a poll relating to the overall dispute can be obtained from every individual participant, including the parties, attorneys, experts, asking "If you were to predict a successful and reasonable settlement number to resolve this matter what would it be?" The responses will give the Mediator an average settlement number as well as a range for where the participants think settlement will occur. The range lets the group see what the collective opinion is regarding the range for settlement negotiations rather each party

staying focused on only what they may want. Research has shown that the collective guess of a group can be very accurate and better than the vast majority of individual guesses (Surowiecki 2004).

Later on, when meeting with multi-defendants, a different type of ballot can be taken to seek input on the percentage of fault by each defendant and the percentage of financial responsibility (Kichaven 2008). This allows multi-defendants to consider respective liability, but also the financial resources available to make an offer to settle the matter (which may include consideration of insurance, contract indemnity provisions, limitations of liability, etc.).

Mediators should tap the collective wisdom of the group. Ballots should be filled out anonymously and independently to elicit the greatest number of individual predictions. The results should be tabulated by the Mediator and discussed. The average(s) will give the prediction of settlement and the individual ballot entries will provide the range. A narrow range will illustrate that the collective group view is fairly consistent in defining the settlement area. Remember, the collective wisdom of the crowd will be superior to the insights of any one individual when attempting to come to a consensus settlement (Surowiecki 2004). The opportunity to harness that collective wisdom should not be overlooked. The ballot process, whether polling the overall range of settlement to defining possible pro-rata sharing of contribution, provides valuable information to the group and to the Mediator.

9 Should There Be Co-Mediators

As discussed above, a team of Mediators may be appropriate in certain multi-party mediations (Crocker, et.al. 2001). Consideration should be given to the need to separately handle different groups of plaintiffs and/or defendants where Co-Mediators can better facilitate the separate groups. Thus, while there is always focus on the global settlement between the plaintiff side and the defendant side, multiple defendants or multiple plaintiffs typically need to mediate the details of any settlement offer or settlement recovery among themselves. Additionally, the addition of Co-Mediators with different styles, technical skills, professional experience, and cultures can be beneficial.

10 Reconvene Joint Sessions And Caucuses For Leverage

As the mediation process evolves, it may be necessary to revise and distribute caucus schedules. Be willing to reconvene joint sessions to discuss progress or impasses with the collective group. Re-poll the participants to find out if the settlement range is getting narrower, or if there has been any changes in the predicted settlement. In the event that the polling reveals a widening range of settlement, the Mediator has data to show that something has to change if the parties want to resolve the dispute.

The concept of leverage cannot be overstated when involved in multi-party mediations. Mediators should take advantage of leveraging alliances in joint sessions and caucuses to find champions in moving the dispute to resolution. Similarly, Mediators should be cognizant of negative influencers and destructive parties so that they can be leveraged by others and motivated to keep the process moving.

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11 Mediation Agreement

The mediation agreement in a multi-party negotiation is absolutely critical. The resolution must be memorialized in detail, including the identification of monetary sums and payment terms, to the identification of who is paying. Additionally, terms regarding release of claims, confidentiality, indemnification, waiver of subrogation claims, and dismissal terms for any underlying litigation or arbitration should be set forth along with how the parties are to pay their own or each other's fees and costs.

Mediation agreements should be drafted immediately to ensure the settlement is memorialized. The mediation agreement should be read by all parties and the Mediator should remain available to answer questions. Before parties sign the agreement, they should be asked if they understand the terms and whether or not they are satisfied with the terms. So long as answered affirmatively, all parties and their counsel should sign the mediation agreement. To the extent that any changes or modifications need to be made in the drafting of the mediation agreement, those changes should be initialed by all parties and counsel. The original mediation agreement should be left with the Mediator, while copies of the mediation agreement should be distributed to all parties and their counsel.

12 Additional Considerations - Insurance Coverage

When mediating a multi-party/multi-issue complex construction dispute, the issue of insurance and surety coverage will most likely be involved. Obtain an understanding of coverage, reservations of right, limitations of liability, subrogation, Owner or Contractor Controlled Insurance Programs (OCIP/CCIP), Sub-Guard protection, performance and/or payment bonds, and/or letters of guarantee. While mediation focuses on the overall dispute and a settlement number, in multi-party dispute matters, the source and limits of proceeds is equally important. It does nothing to agree to a settlement number and not have available revenue sources.

13 Additional Considerations - Fees And Costs

It is also vital that the Mediator discuss the issue of fees and costs from the initial stages of the mediation. In a multi-party dispute, typically the parties do not all have equal share of the settlement, nor do they have equal share of the Mediator's time. The parties need to understand and agree how attorney, expert, even Mediator fees and costs are to be divided. If left to the end of the mediation, when the overall dispute has reached an agreement, the issue of fees and costs can unravel an otherwise successful mediation.

The mediation agreement should detail how the parties are to pay their own or each other's attorney, expert, fees and costs associated with the mediation, as well as how payment of Mediator fees and costs shall be paid. The payment of fees and costs is an area that cannot be overlooked and at times is a critical component of the mediation.

14 Conclusion

Multiple party mediations require that the standard mediation model of a pre-mediation exchange of positions, joint session, and caucus sessions with all parties present be changed. Engagement and commencement of the mediation needs to begin prior to the typical joint session. Scheduling, organization, and management of the mediation process requires that the parties and the Mediator understand that the mediation is a series of steps over time that rarely can be concluded in a single day joint session and caucuses.

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Construction disputes and mediation: a study of the attitudes and experiences of Scottish contracting firms

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Abstract:
The value of mediation has been widely acknowledged worldwide, as evidenced by the number of jurisdictions in which the courts enforce obligations on parties to negotiate and adopt mediation to settle construction disputes. In most contexts, voluntary uptake of the process is low, however, and research into prospective client perceptions is particularly valuable. The principal aim then of this paper is to explore construction participants' awareness, attitudes and experiences relative to mediation, based upon a questionnaire survey of small and medium-sized contracting firms in Scotland. While the bulk of respondents had no direct experience of mediation and felt unable to offer comments on key characteristics of the process, the findings suggest that a sophisticated appreciation of mediation at the client base level may remain illusive in Scotland. Similarly, few firms reported having any policies regarding mediation use and training in, or educational exposure to the process. Nonetheless, a small measure of generally successful mediation activity was charted in our study. This suggests that mediation is currently underused in the sector and increased efforts to promote the process to construction firms through such vehicles as publicity, training, contractual embedding and court promotion are needed.

Keywords:
Attitudes, Contractors, Mediation, Scotland.

1 Introduction

Proponents argue that mediation is a cheaper, quicker, and altogether more harmonious method of dispute resolution than traditional, adversarial methods. Despite evidence of modest growth in the use of mediation within Scottish civil disputes generally (Clark & Dawson, 2007; Clark, 2009), and evidence of the growing use of construction mediation in other jurisdictions such as England and Wales (see Gould et al, 2009), little evidence can be gleaned from the literature regarding construction mediation in Scotland.

The Scottish construction lawyers work we have undertaken has confirmed mediation as a suitable forum for such disputes, the opinion being it can be effective across the spectrum of

construction disputes irrespective of the relationships involved or dispute type (Agapiou & Clark, 2010; Agapiou & Clark, 2011). In most contexts, voluntary uptake of the process is low, however, and research into prospective client perceptions is particularly valuable. In particular, it can be questioned as to whether Scottish construction industry participants share the generally upbeat opinion of mediation expressed by their legal advisors. Indeed, one issue that arose from the previous study was the possibility of clients' unwillingness to engage in the mediation process.

The construction industry has long been painted as a macho, adversarial environment in which hard bargaining and tough reputations may be commonplace. Against this backdrop, we might pose the question then whether construction participants are willing to shift away from traditional approaches to dispute resolution to mediatory techniques, which may strike of a softer, more harmonious note? If they are, what are the drivers towards the adoption of mediation, and if not what are the barriers to change? The principal aim then of this paper was to fill a gap in the literature and chart Scottish construction participants' (specifically the contractor and subcontractor communities') awareness, attitudes and experiences relative to mediation.

2 Related Research

The first major survey into dispute resolution in the UK [England and Wales] construction industry was conducted in 1994 (Gould, 1999). The research found that less than 30 % of the respondents had actually been involved in an ADR process and that the UK construction industry lacked an understanding of the principles of ADR. A second survey by Gould (Gould, 1999) reported an increase in mediation experiences but concluded that 'formal mediation', defined by Gould (1999) as a 'private, informal process in which parties are assisted by one or more third parties in their efforts towards settlement', was rarely employed. Brooker and Lavers' research (Brooker & Lavers 2000) into the processes, perceptions and predictions regarding dispute resolution in the UK construction industry, found that, on balance, negative experience with dispute resolution related to arbitration and litigation, while all other dispute resolution processes produced positive results. Negotiation produced the greatest level of positive experience, closely followed by mediation. Respondents from both UK surveys predicted that, of the dispute resolution processes in the UK, the use of adjudication would make the most significant increase in the UK construction industry over ADR processes such as mediation or expert determination. In a follow-up analysis, Brooker's study (Brooker, 2009) of the use of mediation to resolve construction disputes at the Technology and Construction Court in England would seem to indicate a significant steer from the judiciary on when construction cases are deemed appropriate for the process of mediation. It would seem from the analysis, '*that most cases at the TCC are identified as suitable, particularly if they involve small sums compared to litigation and where there is uncertainty about factual and legal issues'.*

More recently, Gould et al (2009) have investigated the use of mediation in UK construction disputes in which parties involved in litigation at the Technology and Construction Courts in London, Birmingham and Bristol were asked how they settled their disputes, and in particular their experiences with mediation during litigation. The aim of the research was to establish under what circumstances mediation offers an effective and efficient alternative to litigation, as well as to determine whether and at what stage the court could or should encourage mediation.

The results of the survey showed that 35% of those cases that settled after commencing litigation in the TCC used mediation. The vast majority were undertaken as a result of the parties' own initiative, with the parties also agreeing the identity of their mediator. From this

survey, Gould et al (2009) also concluded that successful mediations were undertaken throughout the litigation timetable, and that cost savings attributed to successful mediations were also significant.

In South Africa, research into ADR in the construction industry includes Schindler's (1989) research into the role of mediation and arbitration as dispute resolution mechanisms in the construction industry and Barth's (1991) investigation into the suitability of arbitration as a dispute settling mechanism in the construction industry. Schindler's (1989) research focused on the awareness, experience, attitudes and perceptions of architects, engineers and contractors to mediation and arbitration. Schindler (1989) concluded that these participants did not have much experience in mediation and yet had negative attitudes and perceptions about the process. Barth (1991), in investigating the suitability of arbitration as a dispute settling mechanism in the construction industry, found that mediation was considered a more suitable dispute settling mechanism than litigation or arbitration by the industry participants (including attorneys). Watson (1996) analysed 44 different disputes with a view to establishing the effectiveness of the different dispute resolution processes utilised. Watson (1996) found that 85 % of the cases were resolved through the mediation process at a fraction of the cost and in a fraction of the time involved in a number of arbitrations on similar issues. Povey's (Povey, 2005) survey of mediation practice in the South African construction industry was a notable addition to the empirical evidence, replicating much of the approaches in previous research for a different context. From the survey, Povey (2005) found that that the practice of mediation in the South African industry was not consistent with the accepted principles of the process, that mediators did not as a matter of course assist parties in determining their own settlement, and that mediation activities centred mainly on the collection of information on the dispute by the mediator, as well as the formulation of a solution by the mediator. The respondents to the survey also revealed that mediators' knowledge and use of specific mediation process skills and techniques was inadequate.

There is evidence of growing disenchantment with statutory adjudication particularly in the construction industry, both because of its perceived unpredictability and also because of the increasing role that appeals to the courts seem to be playing in the adjudication process (Kennedy et al, 2010): could mediation be a viable and cost effective option to adjudication and litigation? It is then a very interesting question to ask whether the attitudes of construction industry stakeholders in Scotland creates a real limit to what could be implemented by a government that seeks to promote alternative approaches to the dispute resolution as part of its civil justice reform agenda . We anticipate that the outcome of this research will provide fresh stimulus to the current debate on mediation and further baseline data on the attitudes and perceptions of a wider spectrum of stakeholders on the utility of mediation to resolve construction disputes in Scotland.

3 Primary Data Collection and Analysis

Against this backdrop, this paper focuses on the utility of mediation as a process of dispute resolution within the sphere of Scottish construction disputes, as well as the role of construction participants within the process. It builds upon recent research on the experiences, attitudes and perceptions of Scottish lawyers to mediation in construction disputes (Agapiou & Clark, 2010; Agapiou & Clark, 2011; Agapiou, 2011).

The research is based upon a questionnaire survey of Scottish construction industry contractors and sub-contractors' attitudes towards, and experiences of mediation. An understanding of the views of construction industry participants towards mediation was essential to establish whether it had taken root in Scotland as part of the dispute resolution landscape.

A search in the literature did not produce any widely-based analysis of construction participants' opinions on mediation in Scotland. Research into the subject of mediation, as a dispute resolution mechanism for use in the construction industry has, received some attention in other common law jurisdictions, such as England, South Africa, New Zealand and Australia. Such research has generally aimed at establishing the perceptions, attitudes and experiences of industry participants towards mediation as alternative dispute resolution mechanisms. The questionnaire survey was deployed to build a better picture of the understanding of mediation, its various streams and whether these were being used or were at least being considered for use in the resolution of construction disputes in the Scottish context. The decision was made to survey both contractors and subcontractors to ascertain whether views were consistent between the two-part of the industry in Scotland or, if there was variation, how it manifested itself. Both sections of the industry have aspects unique to themselves and so the questionnaire had to be tailored to suit these differences. Two forms were produced with the same question themes and where possible use of exactly the same questions. We utilised Survey Monkey to gauge the views of participants relative to mediation. The quantitative data was processed and analysed using the SPSS 9.0 software package.

4 Research Findings

In this paper we offer a snapshot of recent survey research conducted with Scottish construction industry participants (mainly small contractors and subcontractors) on their attitudes and experiences relative to mediation. The findings discussed below are based on the survey responses and 63 contractors and subcontractors (hereinafter 'clients') conducted in 2011. Using a membership list of contractors and subcontractors provided by the Scottish Building Federation (SBF), comprising mainly small and medium sized construction firms, we collected responses from 63 firms, representing a response rate of around 18%.

4.1 Knowledge levels

The survey first sought to establish basic awareness levels of mediation throughout the Scottish construction industry base. Around 80% of respondents professed awareness of mediation. While this seems high, given the decades of publicity and promotion afforded to mediation, the finding that one in five respondents had apparently not heard of the process may be surprising. Furthermore, we might speculate that a significant proportion of those who did not respond to the survey were also unaware of the process. It is also worth noting that although the research method did not allow us to ask respondents what they thought that mediation entailed, given that relatively few respondents had practical experience of mediation or felt able to comment on its merit and disadvantages, we might surmise that there is a general lack of any sophisticated appreciation of the process at the industry user level. Those that had awareness of mediation had gathered information on the process from a wide variety of sources including the press/media, professional bodies, lawyers, colleagues and mediation organisations.

4.2 Policies on mediation use

In contrast to the widespread mediation pledges, for example, by public bodies, large commercial entities and Scottish law firms to make use of mediation in resolving disputes, only a small minority of respondents (19%) said that their firm had a policy or practice to consider mediation. A small number (13%) in fact had a policy or practice never to mediate, while in the main respondents had no firm policy or practice as regards mediation use. Such findings are not surprising given the limited experience that the bulk of respondents had with mediation.

4.3 Training and education

In sharp contrast to the high levels of construction lawyers who had received training or education in mediation, our survey found that industry participants in the main (88%) had no such educational exposure to the process. A smattering of respondents had received training either at university/college or through external training courses. Respondents representing contractors and subcontractors may emanate from a wide variety of professional and non-professional backgrounds and the limited reported exposure to educational exposure to mediation holds few surprises.

4.4 Mediation experience

The first and most striking aspect of the survey is that the vast majority of respondents (around two thirds) had no direct experience of mediation. From our survey we tracked 37 cases in which mediation had taken place. The most common types of dispute mediation were change to scope of work and payment (both 11 cases). Other reported cases included delay, professional negligence and damages. Change to scope of work and payment were also considered by respondents to be the two most amenable dispute types for mediation. More research is needed to ascertain what sorts of construction disputes may by their nature comport better with mediation, and why. We are currently exploring such matters in follow up interview work. Despite the very modest levels of take up, in general the mediations that did occur, can be considered to have been a success. Settlement rates were respectable and generally in line with levels reported elsewhere. From the reported cases, some 24 settled (65%) with another 5 (14%) partially settling. We were unable to record what later outcomes occurred in respect of cases that did not settle at mediation, but there exists significant anecdotal evidence in the field that mediations which are not successful often proceed to resolve shortly afterwards at an earlier juncture that would otherwise be the case. Aside from positive results relative to settlement, parties also seemed generally satisfied with the mediation process, in terms of such factors as speed, cost, the mediator and outcomes produced, although the data discerned a small measure of dissatisfaction with the costs time involved in the process. The findings here generally replicate, however, the positive evidence gleaned in the Scottish construction field from our recent study of construction lawyers (Agapiou and Clark, 2011). Given reported concerns over mediation's lack of coercive power, when compared to formal adjudicated outcomes which may carry with them the full force of law (at least on a temporary basis), it is notable that the majority of agreements reached at mediation recorded in the study were reportedly complied with. This finding may be of little surprise given the growing evidence of durability of agreements reached in mediation in Scotland (see eg Ross and Bain, 2010; Samuel 2002 (high levels – 90% and 100% respectively- of mediated settlements recorded adhered to without further enforcement action in the Sheriff Court Small Claims context). Evidence regarding the common adherence to mediated outcomes is often attributed to the fact that active participation in mediation by parties may lead to increased 'ownership' of settlements produced (McEwen and Maiman, 1984).

In terms of why parties mediated disputes, a whole range of reasons were cited, which mirrored commonly painted advantages of the process, the most prevalent being saving costs and time, seeking continuation of the business relationship, finding a creative agreement, the low value of the dispute at hand and assessing the risk of continuing the dispute.

Few parties had declined offers to mediate their disputes, but for those that did, factors which dissuaded them from mediating including the costs of mediation itself, a belief in the strength of their legal case, the idea that negotiation could settle the matter and a jaundiced view that the other side would not mediate in good faith.

Echoing this, failed mediations were typically blamed on the failure of opponents to compromise, with some evidence of tactical use and disputes having become too personal to settle amicably. It is difficult to discern from the findings the extent that lawyer intransigence to the process acted as a barrier to mediation or successful outcomes therein (although 40% of respondents to the question suggested that they had experienced being told by the lawyer not to mediate) . There is substantial evidence, however, of lawyer resistance towards, and cultural barriers towards mediation within legal circles (Clark 2012, chap. 2). Moreover, as discussed further below, a significant number of respondents suggested that ignorance and hostility towards mediation may remain ripe within the Scottish construction law fraternity.

4.5 Attitudes on mediation

Respondents were then asked to respond to a number of statements about mediation on a scale ranging from strongly agree to strongly disagree. Many respondents particularly those with no direct experience of the process, felt unable to offer such views. Nonetheless 25 respondents (40%) provided their perspectives on a range of key policy and practice issues surrounding mediation. Some of the main findings in this respect are discussed here. Table 1 illustrates the frequency and percentage response of respondents' attitudes to dispute resolution and mediation.

The vast majority of those that responded to this section were in favour of some sort of institutional pushing of mediation to put wind in its sails. For example, 76% strongly or somewhat agreed that judges should refer more cases to mediation. Similarly, 76% strongly or somewhat agreed that rendering mediation a mandatory first step in court litigation procedures was an attractive proposition with 71% favouring the widespread use of mediation clauses in contracts. While such findings favouring mandatory referral to mediation may at first blush seem surprising, it needs to be remembered that a compulsory form of extra-judicial forms of dispute resolution (adjudication) is already prevalent within the construction field. Moves towards compulsory referral to mediation, either through contractual embedding or court promotion, also chime with recently expressed views that mandating the process may be necessary to expedite the use of mediation, at least at the outset until levels of acceptance thereto increase (Peters 2010; Clark 2012, chapter 5). Generally speaking the senior judiciary in Scotland (save in the employment sphere, where there exists a recently established judicial mediation scheme in employment tribunals) has done little to suggest an appetite for more robust court promotion of the mediation (see Clark 2008), although it remains to be seen whether the current Scottish government's long awaited legislative response to the recent Gill review into civil justice (Gill 2009)will enhance the prospects of increased court initiation of the process taking place.

In terms of who should mediate disputes the respondents were no less unequivocal. Very few, a mere 4% felt that lawyers made the best mediators, with a whopping 88% stating that in their view those with industry experience as construction professionals were preferred. While more nuanced findings shall be ascertained on this issue by the authors in follow up interview work, the bare opinions expressed here provide food for thought. Such matters tie into the longstanding debate regarding the identity of the rightful inheritors of the mediator's crown.

While there is significant debate surrounding whether lawyers are the most appropriate professionals to act as mediators (Clark 2012, chapter 4), whether subject matter expertise in the area of dispute is an essential tool in the mediator's kit bag is also a moot issue.

It is hardly surprising that construction professionals, used as they are to adjudicators with significant subject matter expertise, should demand the same from their mediators. Respondents also seemed to favour more directive or evaluative styles of mediation that is contemplated by

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the general, facilitative mediation discourse in the UK. Some 46% of respondents views that mediators should offer their own opinions on the merits of the dispute at hand.

With regard to other means of resolving construction disputes, a mixed bag of responses was revealed. Despite the recent push to re-launch Scotland as a centre for arbitration excellence, few respondents (20%) thought the process well suited to the resolution of construction disputes. Litigation fared even worse with only 12% of respondents viewing that it passed muster. This somewhat jaundiced view of traditional forms of dispute resolution were shared by our respondents to our survey of Scottish construction lawyers, albeit that the lawyers were more dismissive of arbitration than litigation. Adjudication, the default process of dispute resolution in many standard contracts, which attracted high levels of praise in our recent survey of construction lawyers (with some 84% stating that the process was well suited to the resolution of construction disputes), did not so fare so well with our client respondents with only 25% viewing it in a similar positive light to the lawyers. At first glance, this seems a striking contradiction.

Obviously the current work is a small study and the findings must be viewed with caution but this negative general appraisal of adjudication chimes with recently voiced judicial concerns (Macob Civil Engineering Ltd v. Morrison Construction Ltd[1]; William Verry (Glazing Systems) Ltd v. Furlong Homes Ltd[2]) about the unsuitability of the process for handling more complex matters and anecdotal tales of poor quality adjudicators. A significant number of respondents (47%) did view however that the prominent place enjoyed by adjudication in the construction dispute resolution landscape blocked out scope for increased mediation use. The unestablished nature of mediation may perhaps thus mean that it often fails to comport with the general *modus operandi* of clients and their lawyers in terms of dispute resolution pathways.

In terms of other barriers to mediation's growth, respondents saw both a lack of awareness of mediation (63% strongly agreed or somewhat agreed) and a negative perception of the process (50% strongly agreed or somewhat agreed) existing within the construction industry as stifling mediation's promise. Interestingly they suggested that construction lawyers similarly may act as roadblocks to mediation's journey in the construction sector by dint of their ignorance of the process (43%) and negative perceptions of it (42%). Although the possibility of socially desired responses cannot be ruled out, respondents were generally keen to play down, however, any notion that the supposed macho, adversarial environment of the Scottish construction sector militated against a role for mediation therein. In this sense, only 16% of respondents agreed with the statement that *"If I participated in mediation more often my standing amongst colleagues would suffer".*

Table 1: Breakdown of frequency and percentage response of respondents' attitudes to mediation

Attitudes	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	Don't know	Response Count

[1] Macob Civil Engineering Ltd v Morrison Construction Ltd [2000] 75 Con LR 101
[2] William Verry (Glazing Systems) Ltd v Furlong Homes Ltd [2005] EWHC 138 (TCC),

If I participated more often in mediation my standing amongst colleagues would suffer	0 0%	4 16%	6 24%	12 48%	3 12%	25
Mediation is inappropriate where there is a power imbalance between the parties	2 8%	13 52%	5 20%	4 16%	1 4%	25
Judges should refer more cases to mediation	7 28%	12 48%	3 12%	3 12%	0 00%	25
Making mediation a mandatory first step in the construction industry would be a positive development	6 24%	13 52%	4 16%	2 8%	0 0%	25
Lawyers make the best mediators	0 0%	1 4%	15 60%	5 20%	4 16%	25
Those with substantial knowledge of the area of dispute make the best mediators	9 36%	13 52%	1 4%	1 4%	1 4%	25
Litigation is generally well adapted to the needs and practices of the construction community	0 0%	3 12%	10 40%	8 32%	4 16%	25
Arbitration is generally well adapted to the needs and practices of the construction community	0 0%	5 20%	10 40%	4 16%	6 24%	25
Adjudication is generally well adapted to the needs and practices of the construction community	2 8.3%	4 16.7%	13 54.2%	1 4.2%	4 16.7%	24
Default to adjudication in many construction disputes renders mediation obsolete	0 0%	10 41.7%	7 29.2%	2 8.3%	5 20.8%	24
Mediation suffers from a lack of coercive power	1 4.3%	11 47.8%	5 21.7%	4 17.4%	2 8.7%	23
Mediation is an opportunity for lawyers to offer further services to their clients	2 8.7%	12 52.2%	5 20.8%	6 25%	4 16.7%	23
Lawyers will lose money if mediation grows	0 0%	9 37.5%	23 46%	16 32%	8 16%	24
Suggesting mediation to an opponent is a sign of weakness	0 0%	3 12.5%	10 41.7%	10 41.7%	1 4.2%	24
Construction contracts should contain a mediation clause	2 8.3%	15 62.5%	5 20.8%	1 4.2%	1 4.2%	24
A barrier to mediation's development in Scotland is its negative perception among construction industry participants	2 8.3%	10 41.7%	6 25%	2 8.3%	4 16.7%	24
A barrier to mediation's development in Scotland is its negative perception among lawyers	1 4.2%	9 37.5%	5 20.8%	3 12.5%	6 25%	24

Mediation training should be compulsory for lawyers	3 12.5%	11 45.8%	5 20.8%	2 8.3%	3 12.5%	24
There is a lack of awareness regarding mediation amongst the legal fraternity in Scotland	1 4.3%	9 39.1%	5 21.7%	1 4.3%	7 30.4%	23
There is a lack of awareness regarding mediation amongst the Scottish construction industry	4 16.7%	11 45.8%	4 16.7%	2 8.3%	3 12.5%	24
Mediation is of more utility in low value disputes	1 4.2%	7 29.2%	10 41.7%	4 16.7%	2 8.3%	24
Mediators should offer their opinion on the merits of the dispute before them to the parties involved	3 12.5%	8 33.3%	6 25%	2 8.3%	5 20.8%	24

5 Conclusion

This is a modest study and a first foray into client research in the area. Further research is required to shed more significant light on the findings unearthed here. In short, however, we can note that at the industry user level, and in respect of smaller firms at least, mediation may remain largely unnoticed, its potential unrealised. Take up is low and sophisticated awareness of the process and the benefits it can reap for participants scant. Much effort thus far has been expended selling mediation to lawyers through educational drives, conferences, seminars and training. Such endeavours targeting undoubted key players in mediation's progress is useful and continuing evidence of the same can be seen, for example, through the recent Law Society of Scotland's, 'Embedding ADR in Civil Justice' conference.[3] Much more needs to be done on the ground in repeating and escalating such efforts for the client base, however.

This is particularly true because in line with evidence worldwide, as our study suggests, when parties do try mediation, they generally enjoy it and often settle their cases. Much research has also suggested that parties (clients and their lawyers) often become repeat players in the process and champions for its cause. Crossing the Rubicon is the hard part. While lawyers may often act as gatekeepers to dispute resolution methods by dint of their traditional dominance in the lawyer-client relationship, recent evidence suggests that clients may be increasingly wrestling control back from their legal advisors in such matters (Clark, 2012, chap. 2) and thus direct selling of mediation to the client base may be of increasing importance to help inform their dispute settlement deliberations.

Further institutional scaffolding that may help to expedite use of mediation in the Scottish construction sector such as court promotion, professional rules mandating discussion and consideration of the process and contractual embedding remain largely absent in Scotland.

There remains much ambivalence from legal professional in Scotland (and the mediation community itself for that matter) regarding the extent that participation in mediation should be any sense propelled through arm twisting (Clark and Dawson, 2007; Agapiou and Clark, 2011). Nonetheless our survey suggests that the appetite for stiffer measures to drag parties into the mediation process may be stronger amongst the client base, at least for those who have had successful experiences within the process.

[3] 16th May 2012, Edinburgh

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Mediation in the Kuwaiti construction industry - practice, barriers and recommendations

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Abstract:

Purpose - Although it is the favoured choice to settle construction disputes in Kuwait, mediation has been rarely used due to some barriers (cultural difficulties and lack of awareness of mediation). This paper explores the deciding factors to use mediation with construction projects disputes, plus the barriers to mediation. Also, this paper presents the findings of what ADR strategies are currently been implemented by different organisations in Kuwait, to avoid litigation. Finally, elimination instruments to the barriers were revealed in this study.

Design/methodology/approach - Two sets of interviews were conducted in Kuwait, with 27 workers in the construction industry, to explore the preferred form of ADR, to identify the main reasons, in terms of culture and awareness aspects, for not adopting the existing ADR forms in construction disputes.

Findings - Mediation and conciliation roles are exist in Kuwait, these regulations were designed for the purpose of avoiding litigation by different organisations. Interviewed workers preferred resorting to mediation in order to settle construction disputes. However, a number of barriers to mediation were explored. The barriers to mediation are found to be, mainly, lack of awareness and another six cultural aspects.

Research limitations/implications - Confidentiality nature of disputes, especially in the Kuwaiti/Arabic culture, was the significant concern of the respondents. Additionally, preparing preliminary sessions due to the low level of knowledge in ADR gave an additional challenge to this research. Finally, translating the interviews' questions from English to Arabic and translating the results from Arabic to English during the transcription and analysis periods, needed extra time and efforts than normal research's transcription and analysis.

Originality/value - The paper provides original data on the practice and barriers to mediation in the construction industry of Kuwait.

Keywords:

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Alternative dispute resolution ADR, Awareness, Barriers, Kuwait construction industry KCI, Culture, Mediation.

1 Introduction

Litigation as a formal way of dispute resolution is time consuming, costly, adversarial and damages, if not destroys, relationships and reputations. Construction law researchers revealed many alternative forms to litigation and arbitration, also in Kuwait different organisations prepared regulations for different forms of alternative dispute resolution. Although two forms of alternative dispute resolution ADR (mediation and conciliation) exist in two different documents produced by two bodies in Kuwait, these ADR guidance are rarely been used because of some barriers. A two-stage interview survey was conducted in Kuwait to investigate the need for ADR in the construction industry and the preferred form of ADR by industry and the reasons of preferring the named form. Furthermore, the causes of the delay of employing the existing forms of ADR in construction industry were under focus.

The cultural and knowledge barriers to employing different ADR forms in Kuwait were explored during the conducted interviews. Different themes from the open ended questions were found. In addition, several suggestions to eliminate these barriers were recommended from the interviewees.

As a part of an ongoing PhD which explores the possibility of implementing different forms of ADR to settle construction disputes in Kuwait, this study highlights the barriers to employing the existing forms of ADR in settling construction disputes. In particular, barriers to the use of mediation were researched through two sets of interviews conducted in Kuwait with 27 specialists in the construction industry of Kuwait from different sectors. The interviewees' perspectives provide a representation view and were picked randomly. All 27 interviewees, in both stages, were chosen randomly from different sectors based on their experience in the construction industry as well as their familiarity with construction disputes in the private sector.

Briefly, findings of this study can be summarised under two main headings: lack of awareness in mediation; and cultural concerns to use mediation. These matters were found to be the main barriers to the employment of mediation in order to resolve construction disputes in Kuwait. Afterwards, the resolutions to these barriers to mediation were indicated in this brief study.

1.1 Aim and objectives of this study

This paper arises out of a PhD study seeking to improve dispute resolution in the Kuwaiti construction industry. The main aim of the paper is to explore the barriers to ADR in the Kuwaiti construction industry, which has been achieved through the following objectives are as follows.

- To explore the requirements of Kuwaiti construction industry (KCI) in terms of resolving construction disputes in Kuwait.
- To identify the barriers to ADR in KCI.
- To recognise ways to overcome the identified barriers.

- To identify and explore good practice and the role of ADR (mediation).

The mentioned objectives, of this paper, are the vital objectives of the whole PhD research, which are concentrating on the data collection and analysis chapters of the mentioned PhD.

1.2 Research limitations/difficulties

Respondents to such studies are difficult to be found, particularly in Kuwait, where the culture makes them keep their conflicts and disputes to the highest level of confidentiality. In which, small number of respondents who have got the desire to be interviewed replied to both interview stages' calls. Some respondents, because of confidentiality, have not answered every question that was asked in the interview. Some other interviewees declined to mention their project's titles, furthermore, some wished to remain anonymous. All respondents and the company names have thus remained confidential in this study, due to the commercial sensitivity of the subject.

Because of the low level of knowledge and lack of awareness in ADR, a preliminary session for the actual interviewees was used to ensure that they understood the concept and principles of ADR and the aim of the whole session was to ensure non-bias and reliable data to eliminate the possibilities of unreliable outcomes. To ensure true judgement of the outcomes after the explanation session which was based on literature and been given before each interview, both interviews' questions and the above mentioned session was prepared by the authors and translated, from English to Arabic, with the assistant of independent expert. Additionally, during the transcription and analysis periods, translation (from Arabic to English) was a must. Translation in the transcription period was conducted directly by the authors and was checked by an independent body.

2 ADR forms in Kuwait

Cheung (1999) states that alternative dispute resolutions arose in the last two decades as a response to the high cost and lengthy process associated with arbitration and litigation. However, ADR procedures tend to be relatively informal, but their range is very wide (Uff 2005). In the United Kingdom different types of ADR mechanisms have been used in order to amicably resolve disputes in construction projects, such as conciliation, mediation, mini-trails and adjudication.

A review of the literature in Kuwait, in depth, proved that there are amicable alternative dispute resolution ADR regulations already in existence. These were prepared by: Kuwait Chamber of Commerce and Industry (KCCI) issued a document called (Nedham Al-Tawfeeq w Al-Tahkeem Al-Tejari: Conciliation and Commercial Arbitration System); and Kuwait Lawyers Association (KBAR) issued (Al-La'eha Al-Ejra'eyah w Al-Nedham Al-Asasi: The Procedural List and The Basic System). In addition, Kuwait Society of Engineers (KSE) which established a department called 'Kuwait Mediation and International Arbitration Chamber - under construction' they are preparing to issue a document called (Qawaed Al-Wasatta w Al-Tahkim Al-Ekhteyari fi Al-Masharie Al-Handasia: Regulations of Mediation and Optional Arbitration in Engineering Projects).

2.1 Conciliation

The Arabic translation of conciliation is "Al-Tawfeeq". Conciliation, as a commercial alternative dispute resolution in Kuwait has been provided by Kuwait Commercial

Arbitration Centre which was established on the 14th of November 2000 as an accredited centre in KCCI. Although this document does not give the conciliator(s) in Kuwait the right to produce binding decisions, conciliator(s) can contribute towards convergence of views. To have the ability to consult The Kuwait Commercial Arbitration Centre, to use conciliation as a type of alternative dispute resolution, there needs to be the following clause included in the contract.

"Any dispute arises upon this contract to be referred to the conciliation in accordance to the provisions contained in the Conciliation and commercial arbitration system of Kuwait commercial arbitration centre".

In addition to having this clause in the contract, to resort to conciliation, the disputants should have the desire to settle their dispute amicably and agree about conciliation. Agreeing to participate in the ADR processes is the most important movement towards choosing conciliation. This was found to be the main reason to why the usage of this and other types of ADR was poor. This conclusion was based on the interviews which will be discussed soon. The procedure of 'conciliation' in Kuwait is found to apply the conciliation regulations of the United Nations Commission on International Trade Law (UNCITRAL). The board of the centre forms an executive committee out of five members, which nominates the conciliation body in accordance with clause 14 of the previously mentioned document. The conciliation body contains either one member or more, who can be selected from the committee itself or externally, to conciliate in the dispute.

Clause 18 of the document states that the party who has the desire in conciliation submits a request to the secretariat of the centre. The request must include a list of the dispute's facts together with the applicant's point of view reinforced by supporting documents. From their side, the centre's secretariat informs the other party about the conciliation request within seven days from the submission day, the other party should reply within fifteen days from the date they were informed, expressing their point of view about the dispute.

The conciliation body studies the case and then invites the disputants for a hearing; the body's main mission is convergence of views, if they agreed about the final version of settlement, then this agreement should be signed. The conciliation body must finalise its mission within three months after their first meeting, extendable to another three months (if needed) by the committee's decision. In the case of a conciliation failure, the disputant's rights would not be affected with any shown or written during the conciliation processes. Finally, the centre provides the disputants, based on their request, with a certificate which describes how the centre viewed this dispute, the reasons why the conciliation trial was failed to settle it, without expressing any comments or views about the dispute.

Some contracts include recourse to a conciliator empowered or required to express his/her provisional view on the merits of the case (Uff 2005). Cheung (1999) stated that Conciliation and Mediation are very similar in both: nature and process. However, the difference has been positioned on the degree of participation by the neutral person. Street (1992) concluded that Conciliation seems to be the preferred choice in international and European usage. Uff (2005) concludes conciliation as "a form of aided settlement in which each side present a summary of its case, in trail mode and using advocates and experts, before a tribunal composed of a senior representative of each side and natural chairman".

2.2 Mediation

Stipanowich (1997) argues that mediation "is the most popular and familiar of settlement-oriented alternatives among contractors, design professionals and attorneys", and he adds that "its popularity appears to be a direct reflection of the relatively positive experiences all these groups report with the process. Construction attorneys generally perceived mediation to be the most effective approach for achieving a wide range of goals, including reducing the cost and duration of dispute resolution", and this is depends on "where parties are able to agree to mediate after disputes arise".

"Mediation, involves a neutral person finding middle ground between the positions of the parties with the aim of achieving a negotiated solution acceptable to all parties. However, in North America and Australia mediation is pre-eminent and in Hong Kong mediation is the favoured choice" (Sayed-Gharib *et. al.* 2010; after Uff 2005; Street 1992 and Cheung 1999). A role of mediation has been provided, on January 2004, by Kuwait Lawyer's Association Arbitration Centre which is a centre at the KBAR. In the introduction of their document, the general manager of the Centre, approved that "employing ADR is not ware or brand that we should mention its advantages anymore but it is a must which been imposed by the reality of today's international commercial".

Opposite to conciliation, the mediator is not contributing to the decision, nor are they pushing any of the disputants towards a settlement. Based on the previously mentioned documents, the main role of the mediator is to neutrally propose the effective procedure(s) towards an effective settlement for the dispute, as if they could do with resorting to expert determination in some points or to resort to arbitration in others. Resorting to *Al-Wasatta*, which is the Arabic translation of mediation, should be agreed by disputant parties of any contract. Again the following clause has been proposed by the general manager of the Kuwait Lawyer's Association Arbitration Centre.

"In case of a conflict between parties upon explanation, application or implementation of this contract to be referred to the mediation process of the Lawyer's \Association Arbitration Centre in the State of Kuwait in accordance to the procedural list and the basic system of the centre".

Another future role of mediation is under preparation and will be provided by The Kuwait Mediation and International Arbitration Chamber which was established on September 2010 by KSE. The main purpose of this chamber is to initiate roles of mediation and arbitration in construction disputes of Kuwait. Similar to conciliation, resorting to mediation should be agreed between parties in all cases, which can face different types of barriers although the role of mediation exists and useful. The barriers to mediation will be discussed in details derived from interviews held in Kuwait with workers in the construction industry who had experience in solved and unsolved disputes.

2.2.1 Regulations of mediation at Kuwait society of engineers

By late 2010, the KSE had established a department called The Kuwait Mediation and International Arbitration Chamber which is still under construction, this department is aiming to issue a document called (Qawaed Al-Wasatta w Al-Tahkim Al-Ekhteyari fi Al-Masharie Al-Handasia: Regulations of Mediation and Optional Arbitration in Engineering Projects) which should be concerning the dispute resolution in construction projects in specific and all types of engineering projects in general.

The Kuwait Mediation and International Arbitration Chamber's chief revealed that the main purpose of establishing this chamber under the society of engineers in Kuwait is to decrease resorting to litigation in order to resolve construction disputes. As they have found that litigation is an impediment to a project's progress and growth, they are intending to adapt the spirit of UNCITRAL regulations to be consistent with the *Kuwaiti Civil Code*. By then they will be ready to mediate in construction disputes. He added that the chamber will train mediators in the future to fill the needs of the construction industry in Kuwait.

2.2.2 Doubts to mediators

Brooker (2007) suggests that when a mediator 'gives advice or offers opinions' for any party in the dispute, this will affect the credibility of the mediator in which risks 'alienating' the whole process. Apparently, this is the case in the Kuwaiti culture, since it is a small community, which makes finding mediators without any type of relationships with one or both parties rare, if not impossible. In this regards, interviewees in Kuwait have been asked about the mechanism of trusting a third party while resolving construction disputes in Kuwait in terms of culture.

2.3 Section 2 in brief

The above recent findings gave the PhD research a new direction, since these regulations are not well-known and not been used regularly in resolving construction disputes. The essential issue of this study is that for some reasons the above detailed forms of ADR are not widespread, however, causes of this shortage were asked in the second stage of the interviews. It is always easier to resort to either mediation or conciliation if it is printed in the contract on the bases of previous agreement between parties, however, resorting to any amicable method of ADR (e.g. mediation and/or conciliation) is always voluntary for all disputants and it is all about the conformity between parties.

In fact, it is all about agreement between parties either before the occurrence of dispute, during the contracting phase, or yet after the dispute occurred between parties. In both cases, before or after the occurrence of dispute, the construction parties are always faced with existing barriers towards ADR. Although some interviewees preferred arbitration, just because it has a binding decision, most interviewees preferred mediation as an alternative dispute resolution in construction disputes. This suits the traditional Kuwaiti culture. For this reason, in this research, barriers to mediation in construction disputes will be considered only.

3 Methodology

A set of 11 qualitative interviews, furthermore, another set of 16 qualitative interviews were conducted in Kuwait with workers in the construction industry during October to December 2009 (1st set) and November to December 2010 (2nd set). Interviewees were selected based on their experience in construction disputes based on preliminary interviews conducted in Kuwait during December 2008 to February 2009 (Sayed-Gharib *et. al.*, 2010). Face-to-face interviews are the most suitable method to collect data in Kuwait, for the sole reason that culture and the social environment in Kuwait depend on eye contact and direct conversation. That is why another stage with more detailed questions has been conducted latter on.

The first set of interviewees was selected randomly on the basis of their professionalism in construction projects and familiarity with construction disputes, regardless the sector that they were working for. Consequently, interviewees in this stage were selected from different

sectors. For this reason, this stage of interviews was broad and open not as specific as the next stage of interviews, however, in the second set of interviews, all interviewees were selected for experience in construction disputes in the Private Sector. Finding interviewees, who have had experience in construction disputes, was with the help of the KSE and the KBAR in which these two organisations have got data of different types of workers in the construction industry who have been involved in disputes previously. The interviewees, in this stage, ought to be categorised as follows: three were reported as investors in construction projects; four consultants in construction field; and a further four experienced contractors in construction projects. Others were: three lawyers experienced in construction disputes; and two experts who act as third parties (i.e. mediators, conciliators and adjudicators) in construction disputes.

The data of the interview revealed that most workers in the construction industry believe that mediation gives a better deal, compromises a solution, shows neutrality, has a non-binding agreement unless signed, is a non-adversarial method, takes a shorter time, is a confidential process, is a flexible procedure, maintains relationships and it is a voluntary process.

Although most of the interviewees agreed that mediation offers massive amounts of benefits, participants commented on the barriers to workability of mediation in construction disputes in Kuwait. The data analysis established an approach to improve employing mediation against the mentioned barriers which frustrated the implementation of mediation in spite its existence in different industries institutes of Kuwait.

3.1 Data analysis

Both sets of interview data were analysed manually by taking matching themes from interviewees' responses. Considering that different words have different synonyms, and sometimes different synonyms have got different meanings. Nonetheless, translating the data from Arabic to English, added a difficulty of different translations. (See 'Research limitations/difficulties' section below).

3.2 Broad-spectrum of the outcomes

3.2.1 First stage of interviews

- Signs of preference of mediation.
- During identifying the requirements of KCI found that there is a cultural problem and lack of understanding of ADR.
- Justification of focusing on construction disputes resolution in private sector.

3.2.2 Second stage of qualitative interviews

- Poor usage of the existing ADR forms.
- Having a preference of mediation rather than any other ADR, in order to resolve construction disputes.
- Suffers of Lack of awareness in the amicable alternative dispute resolution (mediation).

- People in Kuwait need edification of ADR and the benefits of ADR.
- Not only workers in the construction industry but the whole public of Kuwait need this type of education, because each individual will be involved in construction of at least their own house.
- Important concerns (based on culture) for instance: trust and integrity of "ordinary" third party dispute resolution process.

Specific data analysis, detailed outcomes description and discussion are specified soon, just after the research limitations/difficulties and literature review.

4 ADR not litigation or arbitration

Six interviewees, out of 27 interviews with professionals in construction industry, preferred not to resort to ADR in case of dispute in construction projects and keep the existing applicable route (five interviewees preferred arbitration and only one interviewee preferred litigation). The interviewee (a senior lawyer) who preferred litigation had doubts about the workability of voluntary nature of ADR in Kuwait, as people there do not have the will to use such process and they have got used to adversarial forms of dispute resolution. In addition, the interviewee praised the dignity, integrity and impartiality of the judicial authorities. He added "middle eastern culture trusts judicial authorities, and believes in their integrity and impartiality which makes it too difficult to trust neither a third party nor accepting the idea of ordinary person". Finally, because this respondent was interviewed in the second stage, he shared some barriers to ADR with other interviewees, which will be discussed later (see barriers to mediation below).

The other 5 interviewees, who preferred arbitration, have not refused ADR because they are not good alternatives to litigation and/or arbitration; their key reason was in preferring arbitration that 'it is binding'. In other words, they have got doubts to the success of the non-binding processes. However, they have all shown their disapproval towards the high amount of arbitrators' fees and the long time procedure of arbitration (minimum six months) in Kuwait, which is longer than litigation in some cases. Since (82%) of interviewees agreed on ADR and as the objectives of this paper are to explore and study the barriers to ADR (mediation), so the interviewees who refused resorting to ADR in construction disputes will be neglected for now.

5 Mediation in Kuwait

The 15 interviewees out of 27 (71%) who agreed on ADR, preferred mediation as an alternative to litigation and/or arbitration in construction disputes, which suits the situation in Kuwait due to different reasons (will be discussed soon). Nevertheless, they mentioned some barriers to mediation, which will be revealed later. Another 11 interviewees (29%) were distributed as follows: only one (5%) selected conciliation whereas another five (24%) had no clue what to choose, notwithstanding they have agreed about ADR. However, the five interviewees who did not decide what ADR to choose, they were not able to make a decision because of their lack of knowledge in ADR (see barriers to mediation below).

5.1 Conciliation in Kuwait

Only one expert interviewee selected conciliation because of the involvement of the third party in terms of advising the disputants, this interviewee (a lawyer/ex-consultant) had real concerns about the neutrality of the third party. In which the interviewee preferred to give the opportunity for the independent third party to express their views frankly, so both disputants can discover whether the third party is neutral or not, that was why he have not chosen mediation as the best practice

Furthermore, all interviewees have agreed about the barriers to ADR and they do believe in the same barriers to mediation with believers of mediation. The next section demonstrates the 'raison d'être' of mediation which was presented in the literature reinforced by the interviewees perspectives.

5.2 Why mediation?

Although mediation was preferable in both stages of interviews, detailed reasons of preferring mediation were asked during the second stage of interviews only. That is why only twelve interviewees out of sixteen (who decided that ADR is more convenient than litigation and/or arbitration in the second stage of interviews) will be taking into account for this section. Out of 12 interviewees only nine insisted that mediation is the most suitable form of ADR for construction dispute resolution, one preferred conciliation and two interviewees have not had any clue what sort of ADR to choose. Different factors have been argued by the interviewees (i.e. duration and cost of dispute resolution, different effects of the settlement and the nature of the process and the third party in between).

5.2.1 Shorter time

All respondents insisted that mediation saves parties' time which can be wasted through long process and routine of litigation. Two interviewees, a contractor and a consultant, declared that "actually we are looking for shorter process to settle our disputes", whilst other interviewees' opinion was not far away from that. Four interviewees (an investor, two contractors and an expert) agreed about that arbitration did not achieve the purpose that it was found for. Arbitration was found to make process shorter and faster, contrary it made it longer, slower and more expensive (the cost will be discussed below).

5.2.2 Cheaper/cost effective

Disputants are always seeking for lower costs to resolve their disputes. An investor confirmed that "Gaining money is what we are working for, and thus there is no reason to waste it in courts". Although the court's fees are very cheap comparing with the claim's amount (0.01% in best cases), the cost of lawyers are too high (50-60% of the claimed amount). In the words of an interviewed contractor "lawyers cost is an extortion". Two out of three interviewed lawyers objected about the high cost of lawyers and demonstrated that 'lawyers can be in long-term contract with firms, so they take their disputes with no extra fees, it is just the yearly agreed payment!' On the other hand, when arbitration produced to be an alternative to litigation, it was meant to be cheaper and faster as mentioned above, but in fact it became approximately equivalent to litigation in terms of cost if not more expensive, however, lawyers agreed with other respondents (100%) about the effective cost of mediation.

5.2.3 Maintaining relationships

Relationships are always an issue in any kind of conflicts. To maintain relationship (either social or business) disputants must show tolerance and forgiveness toward each other and the conflicted case in between. Nine interviewees (all contractors, consultants and investors) have had the potential to waive their rights in the sake of maintaining their relationships with other parties furthermore their reputation in the market, since it is small community. Definitely, lawyers and mediators have not had an opinion in this part simply because they have not got a right to be waived. Yet, all respondents thought that resorting to mediation offered an advantage to the construction industry, in which it keeps the favourable relations between the parties. Moreover, the mediation option preserves the disputants' reputation between other workers in the industry. Also, mediation can improve the reputation of the parties in some cases, in the sense of they are flexible in emulation to conflicts and do not go extreme in antagonism.

5.2.4 Compromising better deals/flexibility

Negotiating around a dispute most likely gives a better deal, whether parties reached an agreement or they have not. Richbell (2008) insisted that "mediation provides the opportunity for the whole story to be told" wherein disputants will have the chance to listen to each other rather than facing each other in the court or arbitration process. The best deal can be reached while going through litigation process is (Win/Lose) situation, and most likely its (Lose/Lose) situation (Sayed-Gharib *et. al.* 2010). However, because mediation is not a legal argument, both/all parties can be winners, (Win/Win) situation, since in mediation all of the disputants have to agree and say YES to the deal.

Nine interviewees, who agreed about mediation, concurred that having the negotiation opportunity with other parties, with the attendance of a neutral third party, always gives them more comfortable and stronger position in their standpoint. In addition to that, mediation process could reveal for them their own mistakes, if any.

All interviewees, even the ones who did not prefer mediation as ADR to construction disputes, believed in dealing with the dispute by mediation, definitely, results (Win/Win) situation. Not only money wise, but maintain relationships and keeping reputation can be accounted as winning matters in the case of mediation succeeding. This confirms that, the interviewees who did not agree about mediation, either did not accept as true that mediation is booming, or they did not understand what is mediation and how does it work.

Parties resort to dispute resolution in order to defend their possessions and rights. Aiming to get hold of the whole rights might cause losses in other sides of the projects itself or parts of the whole organisation. Disputants can share the (Win/Win) position by compromising a solution, assuming that achieving hundred percent solution, (Win/Lose) situation, is impossible by confrontation. 8 of the interviewees granted that mediation is all about compromising a suitable solution, which might not fit most of the disputants' desires, but it is a fair agreed solution.

5.2.5 Non-adversarial

"Move away from adversarial methods" (Ilter and Dikbas 2009) because adversarial schemes in dispute resolution irritated parties in terms of their stability in the market and relationships with other parties. Eleven interviewees believed that their organisations definitely will be effected if they had a case in the court, one of the interviewees described being in court as "a

headache". Additionally, number of interviewees preferred, in previous disputes, to neglect their rights rather than going through litigation procedures.

5.2.6 Confidential

Confidentiality is very important issue in construction disputes, since it reflects on the parties' reputations and relations with others. Reputation in construction industry is case sensitive; it can be affected by having many cases in the court, and "in fact libellous nature of litigation may perhaps damage anybody's reputation" said by an interviewed investor in construction projects. Protecting parties' reputation is all about confidentiality of the dispute resolution process. Eight respondents agreed that mediation provides the meant confidential process.

5.2.7 Non-binding

The mediation's agreement is not binding for disputants, unless they have signed an agreement, which allows the disputants to resort to litigation during the process or even after the decision was made (before signing the agreement). The non-binding nature has encouraged six respondents to prefer mediation as a trial to settle their dispute before falling into arbitration/litigation routine. Yes, some interviewees argued that this opportunity can be misused (i.e. to delay the opponent and/or to decrease their chances of winning) but mediation worth trying in which it can save massive efforts.

5.2.8 Voluntary

Although mediation is known as a voluntary process, it has been addressed as an advantage to mediation by only four interviewees in Kuwaiti construction industry. The humble percentage indicates lack of acceptance of voluntary mediation and they do prefer mandatory mediation instead which will be revealed soon.

5.2.9 Neutrality

The neutrality of an ordinary third party, not judicial body, is always a question, however, barely two of interviewees accepted that a well trained third party (mediator) is trustworthy, and these two were mediators no doubt. The low percentage can be considered as a deciding factor to mediation. There is a significant percentage of interviewees show doubt on neutrality of mediators (read doubts on neutrality below).

5.2.10 Summary

Nine deciding factors to mediation (see Figure 1) have been agreed by interviewees, the level of agreement varies due to lack of awareness on mediation, however, the short illustration brief sessions were enough for the interviewees to recognise the appropriateness of using mediation to resolve construction disputes. The deciding factors to mediation in this study were picked up from the general speech with the interviewees as themes, with consistency to the advantages of mediation in the literature. The last three factors, which had results of 50 per cent and less, were faced with some disagreement by number of interviewees. The disagreement will be discussed below as 'difficulties to use mediation'.

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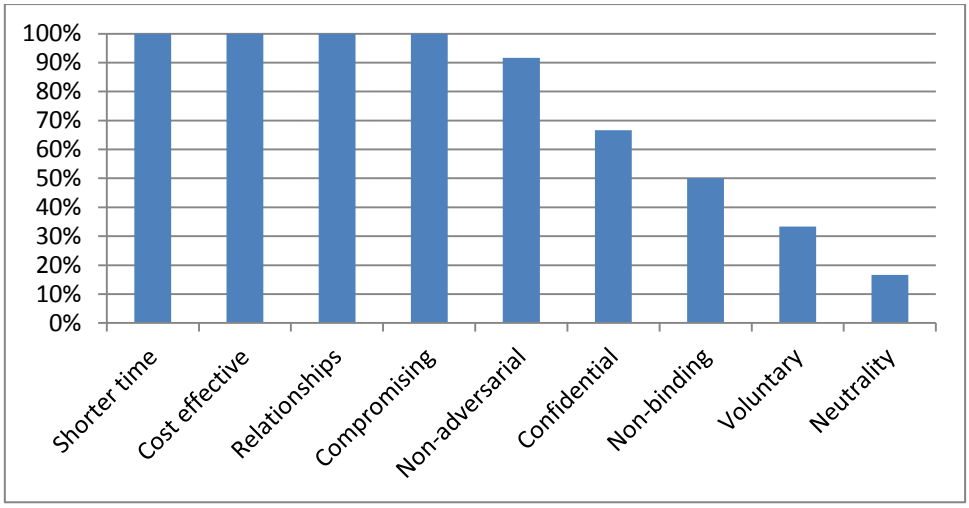

Figure 1: Deciding factors to mediation (advantages)

5.3 Recognition of appropriateness

A huge percentage of interviewees (71 per cent) agreed about the appropriateness of mediation, but due to lack of awareness about it, the usage of mediation was poor in construction disputes. The above mentioned documents conditioned resorting to ADR by certain clauses should be in the contract. Richbell (2008) concluded that 'just because the contract does not specify mediation, it does not mean parties cannot use it' parties can always agree to resolve their dispute in any form of dispute resolution, however, mediation or any other sort of ADR must be agreed in due course before it is too late. On the other hand, respondents consented that resorting to mediation, initially, sounds like an easy choice and a smooth process but in fact it is not. There are other difficulties to employ mediation in Kuwaiti construction disputes, these difficulties will be called barriers to mediation. The following sections demonstrate the Kuwaiti perspective upon the barriers to mediation in construction disputes from the interviewees' experience.

5.4 Difficulties to use mediation

Although the last three (above mentioned) advantages of mediation are common in the literature, and agreed by small percentage of the interviewees but they led the authors to a significant problem toward employing mediation. The data provided indications of difficulties to use mediation. Authors have recognised lack of approval towards ADR due to the lack of acceptance of the said advantages as advantages from large percentage of interviewees, furthermore, some other difficulties to use mediation found during the second stage of the data collection period.

5.4.1 Binding vs. Non-binding

Half of the interviewees were encouraged to prefer mediation to its non-binding nature. Despite the fact that 33 per cent claimed that the decision after mediation trail must be binding once disputants agreed to resort to mediation, no doubt, they do not know enough about mediation. Disputants always, not only workers in the construction industry, have got concerns of their opponents' intentions. The rest of the 17 per cent did not have any clue in this regards because of their lack of awareness.

In addition to the above mentioned 33 per cent of the twelve interviewees who agreed about mediation but not it is non-binding nature, there are the interviewees who have chosen arbitration for this reason which rises that percentage to 47 per cent out of the whole set of interviewees. This high percentage puts a question mark in front the non-binding nature of mediation, however, Richbell (2008) insisted that is dangerous to give the mediator the chance to recommend a binding decision for many reasons; the mediator may use or reveal confidential information given by parties, it can destroy the mediator's neutrality for one of the parties or both, and by binding decision of mediator parties abdicate the opportunity of having a (Win/Win) situation because any third party's decision can be, often, (Win/Lose) to one of the parties.

5.4.2 Mandatory vs. Voluntary

Only 33 per cent considered the voluntary nature as an advantage to mediation, while 67 per cent thought making ADR compulsory by obligating disputants to go through ADR forms before resorting to litigation/arbitration was important, however, from this huge percentage it seems that ADR got to be a mandatory clause in the contract, not an optional choice, in case of dispute, and this could be one of the causes of limited spread of mediation so far.

5.4.3 Doubts on neutrality

Nearly 17 per cent of the interviewees (mediators only) believed in the neutrality of an independent and well trained third party. Surprisingly, 42 per cent of interviewees did show lack of trust in the third party's neutrality neither integrity, on the grounds of that this third party is an ordinary person not judicial body, in addition to that Kuwait is a small country and the opportunities of knowing each other are very high. The rest of the interviewees (41%) did not comment on this part as they are not aware of the situation.

The three above revealed difficulties pave the way for barriers to mediation's widespread in resolving construction disputes of Kuwait. The early findings (barriers to mediation) will be discussed below, in details, in order to diagnose the situation and limitations of employing mediation in the construction disputes.

BARRIERS TO MEDIATION IN KUWAITI CONSTRUCTION DISPUTES FROM INTERVIEWEES PERSPECTIVE

During the second stage of interviews and after discovering, from the first stage of interviews, that the existing ADR process' in Kuwait are rarely used, number of disincentives of implementing ADR were revealed by interviewees in the second stage. The themes of disincentives were categorised based on the redundancy. Two main barriers to employing ADR were shaped; lack of awareness and cultural aspects. Moreover, six different barriers were classified under cultural barriers as the mentioned barriers are well related to the culture.

6 Lack of awareness in ADR (mediation)

6.1 Level of knowledge

Ilter (2009) pointed to the level of knowledge on mediation in the Turkish construction industry, she explored that there is a severe lack of knowledge upon mediation. Although level of knowledge is an important issue, authors discovered from the preliminary interviews

that there is major lack of awareness of mediation in the Kuwaiti construction industry. All interviewees, in both stages, (27) were asked about their knowledge or awareness of mediation. None of their responds were out of the following choices:

- Don't know about mediation, and need brief explanation about it.
- Know about mediation, but not in detail.
- Know about mediation fairly, but not used it.
- Know about mediation very well, and used it.

They have answered this question as follows in Table (1):

Table 1: level of knowledge/awareness on mediation

Respond	Frequently	Percentage
Don't know about mediation (needed brief explanation session before the interview)	**10**	**37 %**
Aware about mediation, but not in detail (procedure and process)	**8**	**30 %**
Know about mediation fairly (but never used it yet)	**5**	**18 %**
Know about mediation very well (used it at least once)	**4**	**15 %**

Although 30 per cent designates the low level of knowledge on mediation, 37 per cent is a significant indicator of lack of awareness of mediation.

6.2 Interest of improving the knowledge and usage

Sixteen interviewees, during the second stage of interviews, were asked about their need and desire to learn more about mediation. The asked questions and detailed answers are discussed below.

Q: If there is an opportunity to learn more about mediation will they go through it? Answers (in Table 2) indicate that 75 per cent have got the desire to improve their knowledge in mediation, which identify the lack of understanding of the mediation mechanism.

Table 2: workers' desire in learning more about mediation

Respond	Frequently	Percentage
Yes	**12**	**75 %**

Maybe, if needed.	**2**	**13 %**
No	**1**	**6 %**
Do not know	**1**	**6 %**

6.3 Interest of using mediation

Another question was asked to the respondents about their consideration of using mediation in resolving future disputes. The results are presented in Table 3 which shows that 63 per cent confirmed resorting to mediation in order to settle their construction disputes in future.

Table 3: Future view of resorting to mediation

Respond	Frequently	Percentage
Definitely	10	63 %
Maybe, if needed	3	19 %
No	1	6 %
Do not know	2	12 %

7 Different cultural aspects

All interviewees, in the second stage interviews, agreed about six cultural barriers to ADR (mediation in specific). Certainly, the respondents revealed on signs of the following six barriers (Figure 2 below) while answering about the advantages of mediation. In fact, views are always vary from place to place, there are some factors which can be addressed as advantages somewhere and can be disadvantages somewhere else, it depends on many aspects (i.e. Culture). So, what can be a deciding factor to use mediation in UK (for instance) can be a barrier to mediation in Kuwait. Below a brief discussion of cultural barriers which revealed by the sixteen interviewees in the second stage:

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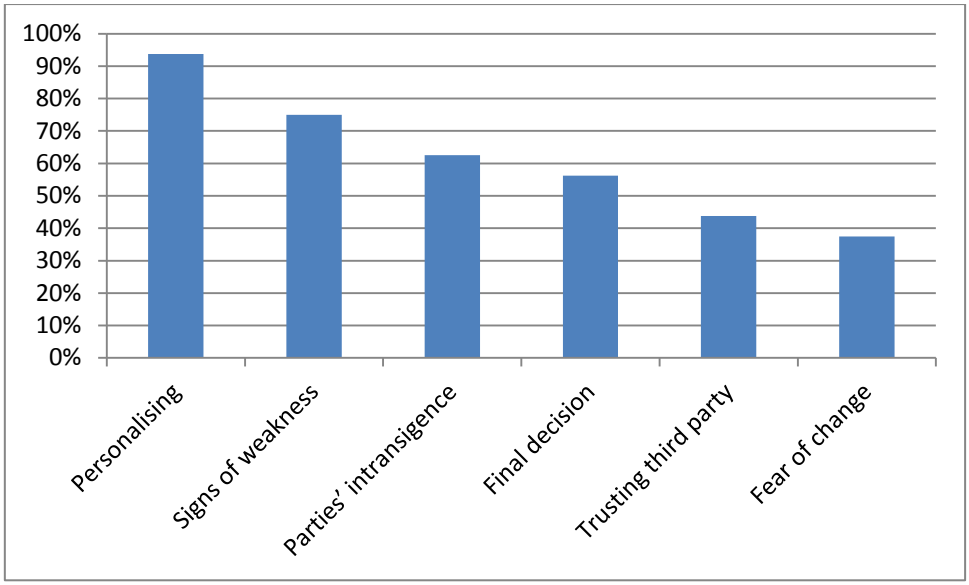

Figure 2: Cultural barriers to mediation

7.1 Personalising

One of the cultural aspects in construction disputes is taking projects' conflicts personally, in which this conflict turns into a personal conflict. Some interviewees found such an incident as normal human being phenomenon. Ninety three per cent of respondents thought that disputants always take their disputes as personal issues due to the prevailing adversarial methods of dispute resolution. A lawyer suggested that "people always think of revenge if they did not get hold of their desired rights". Disputants always seek justice in addition to the 'winner' feeling, so it is all about righteousness.

Mediation can provide the two above mentioned criteria 'justice and feeling'. Yes it might not be the feeling of 'winner' but it is the feeling of 'satisfied', an investor declared "why should I take it personally if we had a smooth resolution". However, mediation is not widespread actually most people never tried it or even heard about it, they never seen a result to be able to judge on the process abilities. An expert suggested 'Successful practice by influencing famous bodies to be revealed to public' by then people may accept to change their view towards taking disputes as personal issues.

7.2 Signs of weakness

The existing contracts do not contain clauses for ADR which shows proposing mediation, or any other form of ADR, as a sign of weakness. Proposing mediation gives, indirectly, feeling of defeat/victory for both parties. In this case, who offers mediation? This is an important question at the beginning of every dispute. In fact offering mediation in due course is a vital, however, none of the disputants have got the potential to offer resorting to mediation due to their prestige. Precisely, 75 per cent of interviewees agreed that offering mediation shows signs of weakness to their opponents, it is a common thought. The only found solution for this barrier is to articulate mediation in the contract at the beginning, so mediation will not be an optional choice any more it will become a compulsory in case of dispute.

7.3 Parties' intransigence

Intransigence is a cultural matter; parties in Kuwaiti construction industry sometimes do have the desire to break their opponent. Sixty two per cent admitted that they had this feeling during disputes and thought they could do it by litigation, however, professionals with their long experience have discovered the impossibility of such a desire, elderly and experts suggested this barrier can be eliminated by obligating parties to resort to mediation.

7.4 Concerns of the final decision's effectiveness

While the mediator's decision is not binding for parties, unless an agreement has been signed, parties have doubts of the reaction of their opponent. Fifty nine per cent of the interviewees noticed their concerns of the finality of the decision, a consultant stated "what if we agreed upon a settlement then the opponent felt uncomfortable and took their actions the next day". Clearly, this is can be addressed as miss-understanding (or low level of knowledge) of mediation. In fact the decision, of mediation, is binding after signing the settlement agreement; indeed nobody signs such an agreement timidly.

7.5 Concerns of trusting non-judicial bodies

Forty two per cent had doubt in ensuring the neutrality of the third party if s/he was not a judicial body. Three interviewees shared the same sentence "we do trust a judicial third party but not an ordinary third party". Hesitations towards the fairness of a third party came on surface because: low level of knowledge of the mediation process, lack of trained mediators and essential reason is *Kuwaiti judicial body's* Impartiality, as a lawyer in construction disputes insisted. Finding trusted, experienced and well trained mediators is definitely the perfect solution.

7.6 Fear of change

There are always fears of trying something new. Litigation and arbitration are readily available, even if these procedures are not convenient, smooth, slow and expensive. But they feel that they know these procedures very well, there is an old Arabic saying says *"what you know is always better than what you do not know"*. Even though the fear of change between workers in the construction industry is 40 per cent and this percentage is not as high as other barriers (see Figure 2) but it should be improved. It seems that the fear came on top almost due to the lack of awareness in mediation, some interviewees suggested helpful solution (i.e. edification and training courses). Although solutions to eliminate barriers are beyond the target of this study but some suggested solution will be discussed below.

8 How to eliminate the mentioned barriers to mediation

As a result, this study paved the way for further studies. Wherein some interviewees suggested new directions for supplementary studies; to eliminate the above mentioned barriers to mediation, and to improve the employment of the existing ADR in Kuwaiti construction industry's disputes:

8.1 Suggested instruments of cultural improvement and edification:

The interviewees suggested different ways to demolish the mentioned barriers. Some of these tools were revealed by other researchers:

- Education: (Schools or Illiteracy Centres);
- Training courses: (Academic or Coaching) trainings for (Long or Short) periods;
- Information: (Books, Booklets, Leaflets, Brochures, Electronics or Internet);
- Media: (TV, Radio, Newspapers or Internet);
- Practice: (by famous organisations and influential people); and
- Events: (Conferences, Workshops or Seminars).

These instruments have the ability to influence the culture and people's awareness.

8.2 Other suggestions to improve the employment of ADR in KCI's disputes

Thirty four per cent of the interviewees agreed that the government must obligate projects' parties to add clauses to the construction contracts in order to force disputants to go through ADR by law. Obligating parties towards ADR was discussed in the literature in different countries. Some researchers found that this approach might affect the voluntary nature of ADR in which does not achieve the goal of ADR (i.e. flexibility), and some other researchers found it as a must for construction contracts due to the massive cost of litigation and/or arbitration and the time overrun in adversarial types of construction dispute resolution.

9 Further discussions and Conclusions

9.1 Mediation in Kuwaiti construction industry and barriers

Although it is not specially designed for construction disputes, a role of mediation exists in Kuwait (see Table 4). Future role(s) of mediation in Kuwaiti construction industry can be considered in further studies. Particularly, while this study focused on the barriers to employing mediation, expectations of exploring future role(s) of mediation would be easier and available.

Table 4: ADR forms in Kuwait

Document name (English)	Provided by	Under (Institute)	Methods discussed	Issued (year)	Usage (based on interviews)
Conciliation and Commercial Arbitration System	Kuwait Commercial Arbitration Centre	Kuwait Chamber of Commerce and Industry **KCCI**	Conciliation and commercial arbitration	2000	Poor
The Procedural List and The Basic System	Kuwait Lawyer's Association Arbitration Centre	Kuwait Lawyer's Association **KBAR**	Mediation and arbitration	2004	Very poor
Regulations of Mediation and Optional Arbitration in	Kuwait Mediation and International Arbitration Chamber - under	Kuwait Society of Engineers **KSE**	Should be mediation and optional arbitration	Under preparation expected late 2011	N/A

Engineering Projects	construction				

This is an in progress research which aims to substantiate the effectively of mediation to resolve construction disputes amicably, neutrally, cost effectively and within shorter duration than litigation. A settlement which keeps reputation of disputants, maintains their social and future business relationships. The above mentioned advantages of mediation were described, by the interviewees, as the deciding factors to mediation.

On the other hand, the interviewees highlighted the lack of awareness and the cultural barriers to use mediation in the construction disputes (i.e. personalising, signs of weaknesses, parties' intransigence, concerns of the final decision's effectiveness, concerns of trusting non-judicial bodies and the fear of change)

9.2 Barriers elimination vs. mediation implementation

Technically, in order to employ mediation as a trail to resolve construction disputes, parties should have agreed to resort to mediation in the case of dispute. The main reason of the pre-agreement is that disputants always feel weakness if they have offered mediation during dispute phase, which makes the agreement upon mediation as dispute resolution process is a must to be articulated as a clause in the contract. Other barriers can be eliminated partially; however, reducing the effect of the mentioned barriers could take long time especially the cultural aspects. Changing culture considered to be impracticable in short time periods. This ongoing research is intending to discover new ways of removing the barriers to mediation, in sequence to implement mediation in construction dispute.

10 Acknowledgements

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Reflections on the requirement for construction contracts in writing under HGCRA

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Abstract:
The deletion of section 107 of Part II of the Housing, Grants and Construction Act 1996 will have a profound effect on the requirements for contracts in writing under the adjudication provisions of the new Construction Act 2009. This paper presents a reflection on the legal provisions and case law concerning the requirement for contracts in writing under the provision of the 1996 Act, against the backdrop of new rules encompassing oral and partly-oral agreements between parties. While the new provisions are unlikely to have an impact in cases where there are formal contracts which incorporate adjudication clauses, the changes are more likely to have an impact where there letters of intent are involved and where contracts in writing are based on standard terms and conditions supplemented by oral agreements. While the legislative changes may not have an impact on the role of the Adjudicator, it may affect their modus operandi, requiring more efforts to ascertain the precise intentions of the parties under dispute.

Keywords:
Adjudication, Construction Act 2009, Written & Oral contracts

1 Introduction

Amidst a flurry of cases during the early years of adjudication, the courts appear to have achieved their aim of resolving questions thrown up by the 1996 Housing Grants Construction and Regeneration Act (HGCRA) and creating a reliable process for the pursuit of adjudication-related claims (Fenn et al, 2008). Increasingly, however, jurisdictional challenges have reduced the effectiveness of Adjudication and increased the cost of the process (The Scottish Executive, 2004). A 2010 study by the Glasgow Caledonian University found that upwards of 25% of challenges to the Adjudicators' jurisdiction were related to whether the contract was in writing (Kennedy et al, 2010). Against the backdrop of recent court decisions, it is clear that case law concerning the requirement for written agreements is still at an evolutionary stage. Given these developments it is timely to reflect upon the case law concerning written agreements against the backdrop of changes to adjudication legislation in the UK.

2 The nature of the Adjudicators' Decision

The creation of the Scheme for Construction Contracts and the Housing Grants Construction and Regeneration Act led to the development of the alternative methods of dispute resolution first proposed by in the Latham Report (Latham, 1994). Adjudication was introduced on a statutory basis under the Housing Grants Construction and Regeneration Act 1996.

Adjudication in the construction industry is a process that provides for the referral of a dispute arising under contract at any time, to a person (an adjudicator) who has to act impartially on the basis of such information as the parties to the dispute are able to provide them or they are able to ascertain for himself within a very limited timescale. He reaches conclusions as to the parties' rights and obligations under their contract on the basis of the information provided by the parties. The decision being set out is contractually binding on the parties until the original decision is finally determined in legal proceedings or by arbitration (if the contract so provides for between the parties) or by agreement between the parties. Adjudication is therefore not final and not binding. The dispute is not settled by adjudication, although it may be if the parties choose to accept the adjudicator's decision as final. Once the adjudicator has made his decision on the rights of the parties under contract, it is for the parties to decide whether they agree with those conclusions, or have the dispute heard again by a tribunal that will give them a decision that is final and binding. The parties are quite at liberty not to accept the adjudicator's decision, although they are bound by the decision, temporarily at least.

Adjudication by itself does not and cannot resolve the dispute. For the dispute to be resolved each party has to decide for itself that it will not take the matter further. An adjudicator states what his conclusions are as to the rights and obligations of the parties. This decision may be based upon very limited information. It certainly will have to be made in a limited time. Both these factors may well mean that the adjudicator's decision leaves a lot to be desired. The adjudicator may certainly not have sufficient time to make a full, forensic investigation. It may be that the adjudicator considers the dispute is of such a nature that it is totally impossible for him to reach any sort of conclusion. To refer a dispute to adjudication, a construction contract must exist (Royce, 2009). Examples abound where parties have argued that all or part of the contract is not 'in writing' to avoid any liability. The courts have considered this aspect on a number of occasions under the provisions of the 1996 Act and held that no contract exists where the agreement is too ambiguous to constitute a contract. What constitutes a contract in writing is an interesting question and fundamental to adjudication under HGCRA, but who decides if a contract is in writing? Does the adjudicator have the power to decide? If no contract exists, then it follows that the Adjudicator has no jurisdiction under the law. However, Adjudicators do not have power to decide on their own jurisdiction. Many adjudicators faced this challenge and either decided to resign or continue with proceedings.

Typically, the decision was an objective one, taking into account factors such the price and scope of works, as well as start and completion dates (Green, 2006).

3 Oral and Written Agreements: The provisions of the HGCRA

The HGCRA required construction contracts to be in writing. Whilst oral agreements were binding on the parties, the difficulty arose in determining the precise terms of that agreement in the absence of clear written evidence. It is for this reason that section 107 of the Act only applied to written contracts unlike the new state of affairs created under the provisions of the Construction 2009 Act. There was a complicated definition of what is meant by the term agreement 'in writing'. Section 107(1)-(6) of the HGCRA 1996 stated:

3.1 107 Provisions applicable only to agreements in writing

(1) The provisions of this Part apply only where the construction contract is in writing, and any other agreement between the parties as to any matter is effective for the purposes of this Part only if in writing.

The expressions "agreement", "agree" and "agreed" shall be construed accordingly.

(2) There is an agreement in writing—

(a) if the agreement is made in writing (whether or not it is signed by the parties),

(b) if the agreement is made by exchange of communications in writing, or

(c) if the agreement is evidenced in writing.

(3) Where parties agree otherwise than in writing by reference to terms which are in writing, they make an agreement in writing.

(4) An agreement is evidenced in writing if an agreement made otherwise than in writing is recorded by one of the parties, or by a third party, with the authority of the parties to the agreement.

(5) An exchange of written submissions in adjudication proceedings, or in arbitral or legal proceedings in which the existence of an agreement otherwise than in writing is alleged by one party against another party and not denied by the other party in his response constitutes as between those parties an agreement in writing to the effect alleged.

(6) References in this Part to anything being written or in writing include its being recorded by any mean'.

In circumstances where a contract was not be covered by section 107, Atkinson (2002) suggested that that courts had taken 'a robust approach to the interpretation of section 107, straining its meaning … so that parties without a contract can benefit from adjudication'.

In A&D Maintenance & Construction Ltd v Pagehurst Construction Service Ltd[1], the court confirmed that, although there was no written contract, both parties proceeded as if there was one and neither party denied a contract was in place, thus an agreement in writing existed. If either party had denied their intention to create a written contract, then an adjudicator would have had no jurisdiction under the provisions of the 1996 Act. In Grovedeck Ltd v Capital Demolition Ltd[2], Grovedeck sought to enforce the adjudicator's decision. In the enforcement proceedings, Grovedeck abandoned the post-dispute correspondence as evidence of the contract in writing and adopted the argument based on Section 107(5). HHJ Bowsher was unable to accept that:

'The contracts were not subject to any terms about adjudication when the Adjudicator was appointed and so, at the date of his appointment, he had no jurisdiction. Did something happen later to change the nature of the contracts between the parties and give jurisdiction to the adjudicator so as to bestow validity on what was proceeding as an invalid adjudication? The claimants say, Yes. The claimants' submissions involve this unstated proposition that even though in every communication after his unlawful appointment the defendants challenged and denied the jurisdiction of the adjudicator, those same communications themselves changed the nature of the parties' contracts and gave him jurisdiction. Freedom of contract has fallen, but I cannot believe that it has fallen that far'

The 'in writing' requirement was applied wholesale to the entire substantive agreement, as endorsed by the Court of Appeal decision in RJT Consulting Engineers v DM Engineering (Northern Ireland) Ltd [2002] All ER (D) 108 (Mar)[3]. *RJT Consulting Engineers Ltd* was the third decision of the Court of Appeal in respect of adjudication.

In RJT Consulting Engineers, the Technology and Construction Court (TCC) held that the documentary evidence and written material between the two parties was sufficient to bring their agreement within the adjudication proceedings. Accordingly the declaration sought by RJT that the agreement was not an agreement in writing for the Act was refused. The matter then came before the Court of Appeal, which overturned the decision of the TCC. RJT argued that there had been confusion regarding documents consistent with there being a contract and documents, which constituted a record of the entirety of the oral agreement. RJT maintained that the whole agreement had to be evidenced in writing in order to provide the certainty, which would enable the adjudicator to move swiftly to a decision within the short timetable provided by the 1996 Act. DM countered that all that was necessary was that there should be evidence in writing of the existence of a contract in writing, whether that would be the identities of the parties, the price and nature of the works to be undertaken. The Court of Appeal agreed with RJT. The invoices and other extensive evidence relied on by DM was simply evidence of the existence of contract. It was not evidence of the terms of the oral agreement between the parties.

Section 107 of the Act details what has to be evidenced in writing is literally the agreement, in its entirety. The only exception to that generally is where relevant parts

[1] A&D Maintenance and Construction Ltd v Pagehurst Construction Services Ltd [1999] (TCC) 64ConLR
[2] Grovedeck Ltd. v. Capital Demolition Ltd. [*2000] B.L.R. 181, 185*
[3] RJT Consulting case (RJT Consulting Engineers v DM Engineering (Northern Ireland) Ltd [2002] All ER (D) 108 (Mar)

of an oral agreement are alleged and not denied in written submissions in adjudication. The appeal was allowed; however, it was noted that what is more important is that the terms of the agreement are material to the issues giving rise to the adjudication and are clearly recorded in writing. The material terms of the agreement must be recorded in any one of the forms prescribed by section 107 of the Act for the requirements of that section to be met and for the agreement to constitute a 'construction contract'.

For a claimant to seek to say that a contract is evidenced in writing pursuant to section 107 (4) of the Act, they must show that the written documentation evidenced the whole of the agreement and not just part of the agreement, as was the case in Debeck Ductwork Installation Ltd v T&E Engineering Ltd[4]. However, in Cowlin Construction Limited v CFW Architects (2002)[5], only a little over a month later, HHJ Kirkham held that:

'It appears that the contract was made partially in writing and partly oral….It is clearly evidenced in writing. Pursuant to section 107(2) of HGCRA, this was a construction contract'.

Whereas, in Carillion Construction Limited v Devonport Royal Dockyard (2002)[6], HHJ Bowsher held that if a variation to the terms of a contract is agreed orally, this must be recorded or evidenced in writing, otherwise n adjudicator will not have jurisdiction to decide disputes arising under the oral agreement. While some suggest that the debate surrounding the requirement to satisfy section 107 has largely been resolved (Gould, 2003), some controversy remained. In RJT, the Court of Appeal decided that the whole of the terms of the agreement (not just the fact of an agreement) must be evidenced in writing, but the possibility to opt out of the 'RJT' principle does exist in particular circumstances. In Connex South Eastern Ltd v MJ Building Services Group Ltd (2004)[7], for example, the court held that there was no oral aspect to the underlying contract (i.e. the meeting minutes confirmed that Connex accepted MJ Building's tender in its entirety) and therefore the Act did apply, whereas in the RJT Court of Appeal case it was found that part of the underlying contract was oral, and the Act did not apply.

In light of the foregoing, it seems that the process of deciding what was considered 'evidenced in writing' and what was not was fraught with difficulty. The apparently restrictive interpretation of section 107 of the Act by the Court of Appeal in RJT remained of real concern within the industry, particularly among smaller firms who fell outside the provisions of the 1996 Act. Concern within the industry was expressed as early as 2004 in a report by the Construction Umbrella.

The report recommended that in respect of 'evidenced in writing', the law should be clarified particularly in light of the RJT case, to avoid undermining the adjudication process altogether if left unresolved. Gould (2003) and Akenhead (2003) both considered the decision in *RJT* unfortunate and suggested that it would create, or potentially create, major problems. Critics suggested that it would open the door to a 'flood of jurisdictional challenges'. There are many written agreements between the

[4] Debeck Ductwork Installation Ltd v T&E Engineering Ltd, *Unreported October 14 [2002] TCC*
[5] Cowlin Construction Limited v CFW Architects *[2002] EWHC 2914 TCC*
[6] Carillion Construction Ltd v Devonport Royal Dockyard Ltd [2005] EWCA Civ 1358
[7] Group Connex South Eastern Ltd v MJ Building Services PLC *[2004] BLR 333*

parties to a construction contract that do not incorporate, necessarily or 'literally', every term which has been agreed. Indeed, some important matters are left to oral agreement, for example, the day on which the works are to commence (Tan, 2007). There may also be many minor immaterial matters, which have been agreed to and are not recorded in writing. If the majority view in RJT was taken 'literally', the construction contract would not be in writing or, at least, as fully in writing as the judgments had suggested were required. However, the House of Lords refused a petition to appeal.

Certainly, the RJT decision considerably limited the right to adjudicate where no written contract agreement exists, but the decision was reached not because the court wished to restrict the right to adjudicate, but as LJ Ward foresaw, the difficulty an adjudicator would have making a decision based on an alleged oral agreement within the tight timeframe provided by the process (Brawn, 2010).

Indeed, as LJ Ward stated:

*'*Certainty is all the more important when adjudication is envisaged to take place under a demanding timetable. The adjudicator has to start with some certainty as to what the terms of the contract are'

Nevertheless, there is still controversy about the effect of section 107 as construed by the decision in *RJT.* In the early 2000s, some within the construction industry called for the abolition of the requirement so that all construction contracts even those which are oral or partly in writing are covered by the Act (Bowes, 2007) (akin to legislation in New South Wales); others preferred the status quo (Kennedy et al, 2010).

4 Contracts in writing: recent developments

A closer examination of the precise terminology of the 1996 Act is fundamental to the understanding of the law concerning contracts in writing and the nature of what constitutes a contract under HGCRA. The 1996 Act used wording such as 'by reference to terms that are in writing'. There is no reference to a 'previous agreement that is in writing'. Indeed, there is no provision for adjudication in relation to an alleged construction contract made orally or otherwise not evidenced in writing –see Carillion Construction Limited. This would seem to be contrary to the provisions of section 107 (1) of the 1996 Act. What constitutes a construction contract? What is the basis of the agreement? There must obviously be agreement on scope, price and time. On the contrary, what if there was no agreement over time? Certainly, there would be an implied term within the contract that the works will be completed within a 'reasonable time', but does this provide us with certainty that a contract exists where the scope and price are more precise? What if the contract alluded to reasonable costs incurred? What if the identity of the parties was uncertain?

What if the scope of works was based on subsequent instruction or orders, which may or not be set down in writing? In such circumstances is there any guidance we can draw upon as to what constitutes a construction contract? Section 107 of the Act only applies where there is a contract in writing, meaning that all material terms must be in writing; see RJT as the leading authority in the area. Justice Jackson has also provided

additional guidance on the constitution of a construction contract more recently in the case of Mast Electrical v Kendall (2007)[8]. Justice Jackson noted that a thorough analysis of correspondence, meeting minutes and so on was warranted to establish whether a contract was ever concluded between parties. He also noted that where there had been performance '*the court would lean in favour of finding a contract if it could probably do so'.* What if there was no agreement on all the material terms between the parties? Under RJT principles there would be no contract, but the contractor may be entitled to a quantum meruit under contract law provisions.

In all circumstances, courts would be obliged to follow the principles established within RJT. In other words, as Brawn (2010, pg. 37) has noted, either:

- 'The contract must be in writing;
- Established by means of communication in writing;
- Evidenced in writing;
- Agreed by reference to terms in writing; or
- Exchange of submissions in proceedings in which the existence of contract is alleged by one party and not denied by the other party'

The decision of the court in Hart Investments Limited v Fidler (2006)[9] provides a further example of an authority in this area.

In terms of the role of the Adjudicator, they would need to adopt a rigorous approach in determining whether minor issues said to have been agreed orally between parties prevent an otherwise written contract pursuant to section 107 of the Act being considered as a contract in writing. The exercise itself must be objective and take into account the nature of the contract and the parties themselves. Nevertheless, what may be a minor issue in one contract may not be minor in another one**.** In for example, a 10 million pound project an oral agreement on different types of architectural hardware may be a minor issue but a major one on another development. The adjudicator would also need to consider the intention of the parties, and whether they intend to give affect to their oral agreement such that it becomes binding in written form at later stage. On the other hand, a later oral agreement may not be binding on parties because it lacks consideration or because it was not intended to be binding, as in the case of Allen Wilson Joinery Ltd v Privetgrange Construction Ltd [2008][10]. There remains a great deal of legal uncertainty about the effect of subsequent oral amendments to written contracts or oral variations to the scope of works, to the extent that differences of opinion have emerged among legal practitioners.

While some consider that the right to adjudicate was lost under the 1996 Act, others considered the right to adjudicate unaffected, particularly with respect to oral amendments to the works. The debate has provided a fertile ground for challenges to the Adjudicator's jurisdiction under the 1996 Act. Indeed, what if the written terms of

[8]

[9] Mast Electrical Services v Kendall Cross Holdings Ltd [2007] EWHC 1296 (TCC) (17 May 2007)
[10] Allen Wilson Joinery Ltd v Privetgrange Construction Ltd [2008] *EWHC 2802 (TCC)*

the contract were incomplete or further terms agreed orally, or significant changes to the scope of works agreed on an oral basis?

Is there any guidance we can draw upon in such circumstances? The answer to this question is yes. For instance, in Hatmet v Herbert (2005)[11], there was sufficient written evidence as to the scope of the work, price and timeframe, but little information on the basis of price revision. In these circumstances the provisions of section 15 of the Sale of Goods Act (1992) such that an implied term would apply that would require a reasonable price be paid for any price revision. In Carillion Construction Ltd v Devonport Royal Dockyard Ltd (2005)[12], a written contract was varied mid-way into the works by an oral agreement. This changed the basis of the payment to a cost-reimbursable one. The court held that the adjudicator had no jurisdiction to decide whether an oral agreement varied the written one. The adjudication was deemed invalid by the court under the prescriptions of the 1996 Act. Letters of intent are a common feature of the contract-forming process in the construction industry, but do they have any currency under the provisions of section 107 of the Act? The answer to this question is no.

Where the works are undertaken under a letter of intent it will be difficult, but not impossible, to demonstrate that an agreement in writing exists as prescribed under section 107. This is because by the time a dispute has arisen further agreements have usually been made that are either inferred from conduct, where they agreed orally, or not evidenced by the letter of intent. It is also common for parties to rely on particular documents as evidence that a contract exists during adjudication, but are there any legal implications under the provisions of the 1996 Act? The answer to this question is yes.

Where a party, relies upon a particular document as evidence of a contract when adjudicating, it will be bound by the terms within that document. Subsequently, if evidence emerged under the old rules that there are other terms not recorded in that document, even if they are recorded in other documents, then if the adjudicator takes those other documents into account in his decision, that decision is unlikely to be enforced by the courts. In for example, Redworth Construction v Brook dale Healthcare (2006)[13] the court concluded that while the 'contract' referred to adjudication, it did not meet the RJT test of an agreement in writing as prescribed under section 107. In terms of agreements as to the scope of works and subsequent oral variations, there are three noteworthy cases. In Deback v T&E Engineering (2002)[14], the contract between the parties was not adequately evidenced in writing because the fax relied upon by the plaintiff did not sufficiently establish the scope of works.

In Management Solutions Professional Consultants Limited v Bennett (Electrical) Services Limited [2006][15] and ALE Heavylift v MSD (Darlington) Limited [2006][16], the parties waived the need for instructions to vary the scope of works to be confirmed

[11] Hatmet Ltd v Herbert [2005] *EWHC 3259 TCC*
[12] Carillion Construction Ltd v Devonport Royal Dockyard Ltd [2005] EWCA Civ 1358
[13] Redworth Construction v Brookdale Healthcare (2006) 110 ConLR 77)
[14] Debeck Ductwork Installation Ltd v T&E Engineering Ltd, *Unreported October 14 [2002] TCC*
[15] Management Solutions Professional Consultants Limited v Bennett (Electrical) Services Limited [2006] EWHC 1720 (TCC)
[16] ALE Heavylift v MSD (Darlington) Limited [2006] EWHC 2080 (TCC)

in writing. The argument upheld by the courts was that the absence of confirmation in writing did not take the contract outside the scope of section 107 of the 1996 Act. The principle being that where a written contract provides that instructions allowing variations to the scope of works are permissible if confirmed in writing, a contract in writing still exists even if the instruction given under the authority of the contract is not confirmed in writing.

What about the inclusion of implied terms in a construction contract? Does this transform an otherwise written contract into one that is no longer written under the provisions of section 107 of the 1996 Act? The answer to this question is no. According to Royce (2009) '*it was manifestly not the intention of parliament to exclude from the jurisdiction of an adjudicator an agreement solely because it contains implied terms'*, as endorsed by the court in Connex South Eastern Ltd[17] *and more latterly* Allen Wilson v Privetgrange Construction [2008][18]. Rather, Parliament's intentions were to avoid a situation whereby one or other party would suggest that a contract, otherwise not complete under the provisions of section 107, could be completed after execution by virtue of implied terms representing the 'unexpressed intention' of either party, as noted in Galliford Try Construction Ltd v Michael Heal Associates Ltd [2003][19]. We know that implied terms operate by virtue of the law. Such terms are implied into contracts for different reasons. Whereas, some terms are implied into contracts to give effect [for example, business efficacy] to a contract, other terms are implied to provide context to an actual relationship between parties. Should we differentiate between different types of implied terms within the context of section 107? The answer to this question is no, according to Royce (2009).

Thus, there is no reason why any type of implied terms transform an otherwise written contract into one not covered by the provisions of the 1996 Act; see for example, Allen Wilson v Privetgrange Construction [2008][18], as an example of an authority in this area. The remaining provisions of Section 107 merit also closer scrutiny.

This is because they provide other means by which agreements can be made in writing under the provisions of the 1996 Act.

Section 107 (4) states

'An agreement is evidenced in writing if an agreement made otherwise than in writing is recorded by one of the parties, or by a third party, with the authority of the parties to the agreement'.

Section 107 (5) states:

'An exchange of written submissions in adjudication proceedings, or in arbitral or legal proceedings in which the existence of an agreement otherwise than in writing is alleged by one party against another party and not denied by the other party in his response constitutes as between those parties an agreement in writing to the effect alleged'.

[17] Group Connex South Eastern Ltd v MJ Building Services PLC *[2004] BLR 333*
[18] Allen Wilson Joinery Ltd v Privetgrange Construction Ltd [2008] *EWHC 2802 (TCC)*
[19] Galliford Try Construction Ltd v Michael Heal Associates Ltd *[2003] EWHC 2886 (TCC)*

The wording of Section 107 (5) is controversial and worthy of closer examination. The wording seems to suggest that if one party to adjudication alleges the existence of an oral agreement under their terms, and the other party does not deny the agreement on this basis, then there will be an agreement in writing. Thus, in spite of the ruling in *RJT* it does seem possible to create a written agreement from an oral agreement which is oral or partly oral if the agreement is asserted in written submissions in an adjudication, arbitration or legal proceedings where the other party does not deny that agreement. It is difficult to believe that Parliament's intention was to create something so manifestly unjust. Is there any guidance we can draw upon? The answer to this question is yes. In, for example, Grovedeck v Demolition [2000][20], the court held that section 107(5) had a narrow focus. In other words, it only applied where an oral agreement has been admitted in a previous adjudication, but most responding parties would raise an *RJT* jurisdictional challenge on the basis of section 107 in that first adjudication. Thus, a party who does not raise the challenge initially would lose the right to challenge on those grounds in subsequent adjudications. However, is it also worth examining the precise wording of section 107 (5) against the backdrop of parliamentary intentions and deliberations at this point. An examination of the proceedings of the House of Lords for 23rd July 1996 on the wording of section 107(5) reveals no mention of 'adjudication proceedings'. It seems that the upper chamber of Parliament incorporated an amendment proposed by the House of Commons, in which the words 'in adjudication proceedings or' would immediately follow the word 'submission'.

According to Royce (2009) Parliament's intention was to make reference to the '*other, prior'* adjudication proceedings, not to provide an adjudicator with jurisdiction over proceedings for which he did not have at appointment based upon submissions made by one party to otherwise unauthorised adjudication. We know that amendments to the Act will repeal Section 107 of the 1996 Act in its entirety.

This will mean that adjudication provisions will apply to all construction contracts whether written or oral, or even partly in writing and partly oral. However, the new Act will also amend section 108(2) whereby all the provisions setting out the required adjudication procedures will have to be in writing. If they are not in writing the Scheme for Construction Contracts will apply. There have been two recent cases that have caused some confusion among practitioners in relation to contracts in writing. In T & T Fabrications v Hubbard [2008][21], the decision of an adjudicator was not enforced on the basis that certain terms of the contract relating to the provision of drawings and the timing of the works were not in writing.

The terms concerned the scope, quality and essential of the works and there was a genuine dispute as to whether these terms had been agreed. Therefore, there was an arguable case that the terms of the contract were not in writing. However in the second case, Allen Wilson Joinery v Privetgrange Construction Limited [2008][22] it was held, firstly, that implied terms do not prevent a contract from being in writing and, secondly, that a budget price with a final price to be agreed does not prevent there being a contract in writing. In sum, the HGCRA required the contract to be in writing (or at least those

[20] Grovedeck Ltd. v. Capital Demolition Ltd. [*2000] B.L.R. 181, 185*
[21] T & T Fabrications v Hubbard [2008] EWHC B7 (TCC)
[22] Allen Wilson Joinery Ltd v Privetgrange Construction Ltd [2008] *EWHC 2802 (TCC)*

evidenced in writing), if the adjudicator's decision was not to be challenged on jurisdictional grounds. There have been large numbers of challenges where the contract was not in writing or not evidenced in writing under the UK regime, but much fewer incidences and disputes in other jurisdictions elsewhere. In New Zealand, for example, the Construction Contracts Bill (CCB) not only provides for written contracts, but also to oral or partly written and partly oral contracts (Tan, 2007). The BCISP Act in Singapore and NSW (Section 7(1)) too define a "contract in writing" in relatively wider terms, to the extent that it would extend to a loose collection of documents, exchanges and invoices (Chow, 2005). This suggests that the proposed amendments to HGCRA may not be as problematic as some commentators anticipate. The removal of section 107 of the 1996 Act, so the requirement for a construction contract to be in written form may render the RJT principles and subsequent legal judgements ineffectual. However, it is important to note that, until the amendments to the Act come into force, the case law remains effective.

5 The Construction Act 2009: implications of impeding change to the requirements for contracts in writing

The Local Democracy, Economic Development and Construction Act – *the Construction Act* 2009 -received Royal Assent in July 2009 (Brawn, 2010), and came into force on 1st October 2011 (in England and Wales). The new legislation amends Part II of the Housing Grants, Construction and Regeneration Act 1996.

The main benefits of the new Act, as conceived by the Government, was to improve cash flow in the construction supply chains and encourage parties to resolve disputes by adjudication rather than by arbitration or litigation (Gwilliam, 2010). The main changes effected by the new Act are:-

- Adjudicators will no longer be limited to contracts in writing;
- Adjudicators will be able to correct their decision if a clerical or typographical error is made; and
- Parties will not be able to agree a term which provides for who is to bear that costs of an adjudication until after the adjudicator has been appointed.

The most significant change is the abolition of the requirement for contracts to be in writing. The amendment will apply across the new Act and cover the payment provisions. This will mean that even purely oral agreements will now have to incorporate the payment provisions and the need for notices (Brawn, 2010). Nevertheless, some claim that the deletion of the requirement for contracts to be in writing will create greater uncertainty for the adjudication process, leading to a greater potential for injustice. Agreement on material terms, however trivial, is undeniable and for adjudication to be available these have to be in writing. This level of certainty provides the adjudicator with a greater sense of parties' intentions and further understanding as to the nature a contract. However, there is a perception that HGCRA mechanisms were open to abuse, particularly by those with the greater bargaining power within the industry (Gwilliam, 2010). The new legislation may not only provide smaller

contractors, often less adept at dealing with contractual matters with greater protection against abusive practices, but also greater access to the adjudication process itself. This is an important aspect of the change since many verbal contracts or written agreements involving oral variations typically involve smaller, more financially vulnerable sub-contracting firms.

6 Summary and Conclusions

This paper reflects on the legal provisions and case law concerning the requirement for written contracts under the provision of the HGCRA 1996, against the backdrop of new rules encompassing oral and partly-oral agreements. The HGCRA (s107) required contracts to be in writing (or at least evidenced in writing), to preclude challenges to adjudicator's decisions on jurisdictional grounds. Cases such as *Grovedeck Ltd v Capital Demolition Ltd* [2000]; *RJT Consulting Engineers Ltd v DM Engineering (NI) Ltd* [2002]; and *Carillion Construction Ltd v Devonport Royal Dockyard Ltd* [2003]; *Allen Wilson Joinery v Privetgrange Construction Limited [2008]* have demonstrated the position of courts pursuant to section 107 of the 1996 Act. It will be interesting to see how the amendments to Section 107 of the 1996 Act will operate in practice. We can only speculate on the likely impact on industry at this time.

While the new provisions are unlikely to have an impact in cases where there are formal contracts which incorporate adjudication clauses, the changes are more likely to have an impact where there letters of intent are involved and where written contracts are based on standard terms and conditions supplemented by verbal agreements. While the legislative changes may not have an impact on the role of the Adjudicator, it will affect their modus operandi. The adjudicator will need to find additional time to consider the formation of the verbal contract to ascertain the precise intentions of the parties. Inevitably, where oral agreements are concerned, adjudicators will also need to consult witnesses and where differing views exist there will be a need to probe witness statements through some form of cross-examination process. This is likely to be highly contentious, potentially giving rise to grievances, injustice and challenges to adjudicators' decisions.

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State Consent to the Agreement of its Entities in Investment Arbitration

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Abstract:
In privity to an arbitration agreement of a state corporation whether commercial or public, the consent to the agreement is not always as straightforward as it is for a business corporation. This is because of substantial governmental influence over the structure, function and control of the state corporation which sometimes refers to state and state corporations as single economic unit. When an independent State entity enters into an investment agreement with a foreign investor substantial control and supervision of the owner state plays an important role in it. But in case of any liability of a state entity, in most cases, states raise the argument of separate legal personality of its entity. This is probably the main reason for the incorporation of independent state entity by the state. This paper examines the rationale behind the formation of a state entity and substantial structural and functional control of the government in the agreement of its entity, the reason why state should be a party to the agreement of its entity.

Keywords:
Agreement of State-entity, Investment Arbitration, Piercing Corporate Veil, State controlled over the entities.

1 Introduction

In most investment arbitrations where a state challenges the jurisdiction of a tribunal it argues that it is not a party to the arbitration agreement. Recent English Supreme Court decision has established the precedent that the state is not a party to the arbitration agreement of its independent state entity. [1] The initial stage of establishing attribution of conduct of a state entity to the state in investment arbitration is to determine whether the state is a party to the arbitration agreement entered into by its entity. The significant characteristics of most state entities are that they have separate legal personality incorporated under national law by the government to undertake commercial activities on behalf of the state. Besides operating commercial affairs they also have public policy objectives, which entail state entities to serve the purpose of the government in some form similar to government agencies established to pursue purely non-financial objectives.

[1]*Dallah Real Estate and Tourism Holding Company v The Ministry of Religious Affairs, Government of Pakistan* [2011] 1 A.C. 763.

If we look at the basic nature of formation of contract, an agreement of a competent independent business corporation is clear to prove consent or directive mind of whether or not it is an absolute consent or influenced unduly or it was not his consent at all. On the other hand, when we talk about privity to an arbitration agreement of a state corporation whether commercial or public, the consent to the agreement is not always as straightforward as it is for a natural person or ordinary business corporation. This is because of substantial governmental influence over the structure, function and control of the state corporation which sometimes refers to state and state corporations as single economic unit.[2] Moreover, when it comes to the question of attribution of state liability for the agreement of its entities, it would be unreasonable for the arbitral tribunal to predict whether they should separate the liabilities of state entities from the state.

When independent State Corporations enter into investment agreements with foreign investors under the substantial control and supervision of the state to realise a common economic transaction, advance planning for dispute resolution becomes an inherently complex mechanism.[3] One of such complexities involves lifting the corporate veil of state entities whether the state has to be a party to the agreement of its entity. The crucial impression such piercing leaves is that of uncertainty and unpredictability of the party hood of its parent state. Such uncertainties are detrimental to the legitimate expectations of the parties to a contractual relationship, and involve serious risks associated with the enforcement of arbitration awards. The aim of this brief paper is to examine the rationale behind the formation of a state entity and whether the home state is a party to the agreement of its entity. To this end an attempt will be made to analyse the negotiators and directing minds of state entity when they conclude investment agreement. This will also scrutinise and explain the specific relevance of piercing the corporate veil of state entities in investment agreement.

2 Rationale behind the Formation of a State Entity

In general state entities are separate legal personality and their conducts shall be treated as distinct from the activities of the government and shall not be attributed to the state. However, several exceptions may qualify these principles and hold the state liable for the agreements of its entities; the separate legal personality may not be respected if the corporate veil has been created as a means for fraud and evasion.[4] Besides, conduct of state entities will be attributed to the states in cases where the corporations exercise public power.[5] Another exception concerns a situation of ownership by the state where control is exercised in order to achieve a particular result.[6] To better understand the concept of piercing the corporate veil, it would be helpful to examine the need for having the corporate form of state-entities in the first place.

According to Janet Dine, the limited liability corporation is the greatest single discovery of modern business and trade practice in the world, because a greatest portion of the world's

[2] Rudolf Dolzer & Christoph Schreuer, *Principles of International Investment law* (Oxford 2008) p.200; Gower and Davies, *Modern Company Law* (8th edn., Eweet & Maxwell 2008) p 203; Interim Award of September 23, 1982 in No.4131 (original in French), reprinted in IX ICCA Yearbook of Commercial Arbitration 131, 134 (1984); Yaraslau Kryvoi, 'Piercing the Corporate Veil in International Arbitration' (2011) vol. 1. 1:169 Global Business Law Review, p.174.
[3] Gillis Wetter, 'A Multi-Party Arbitration Scheme for International Joint Ventures', (1987) vol. 3 ARB. INT'L p.2.
[4] Barcelona Traction Case, Judgement, 5 February 1970, ICJ Rep. (1970) 3, 39, paras 56-58.
[5] *See Philips Petroleum v Iran, 21 Iran* USCTR (1989) 79.
[6] *See* J Crawford, The International Law Commission's Articles on the State Responsibility (Cambridge University Press 2002) 113, Para 6; *See also Foremost Teheran v Iran*, 10 Iran- USCTR (1986) 288; *American Bell v Iran*, 12 Iran-USCTR (1986)170.

business and trade is conducted by corporations.[7] However, corporations are most often used by the incorporator as a tool to avoid liability of any unforeseen debt incurred in the course of business conduct. In relation to state entity, the purpose is same to ordinary business corporations; they are created by government to undertake commercial activities on behalf of an owner government. Arguably, the main function of corporate law is defining the property rights over which the participants in a commercial firm can enter into contracts.[8] Henry Hansmann and Rainier Kraakman explained that "the essential role of organisational law is to provide for the creation of a pattern of creditors' rights a form of 'asset partitioning' that could not be practically established otherwise."[9] Therefore, it is obvious that rationale behind the incorporation of separate legal entity by a sovereign state is to put a veil between the entity and the state's assets against any foreign debt of its entity.

To separate incorporators and the participants from the liability of the corporation corporate scholars rely on two major theories concerning corporate personality which are the theory of legal entity, and the theory of legal fiction. The entity theory is based on the principle that the state created the corporation by granting it a charter, and, therefore, it has a separate "personhood."[10] On the other hand, according to the legal fiction theory, a corporation is an outcome of contracts, a more convenient way of structuring relationships with third parties, thereby limiting the participants' personal liability. The private corporation or firm is simply one form of legal fiction which serves as a nexus for contracting relationships and which is also characterised by existence of divisible residual claims on the assets and cash flows of the organisation which can generally be sold without permission of the other contracting individuals. [11]

The legal fiction supporters argue that the property might be given special qualities by the state or through contract, but remains property all the same.[12] Thus, the existence of a corporation independent of its owners is a fiction "the rights and duties of an incorporated association are in reality the rights and duties of the persons who incorporate it, and not of an imaginary being." [13] The entity theory school regards a corporation as an autonomous institutional actor separable from those with an interest in it.[14] In most cases in investment arbitration when it comes to the matter relating to state liability for its entities, the state argues on the basis of separate legal personality of the entities.[15] However, it has been noticed that states also argue to pierce the corporate personality to save its entity's asset from compensating foreign debt.[16]

The concept of legal fiction theory has probably started to emerge after the decision in *Salomon v Salomon* on the separate legal personality of a corporation.[17] This theory has not

[7] Janet Dine, *Company Law* (3rd edn., Macmillan, 1998 p.1); See Len Sealy, Company Law and Commercial Reality (Sweet & Maxwell, 1984).
[8] Henry Hansmann & Reinier Kraakman, The Essential Role of Organizational Law, 110 YALE L.J. 387, 440 (2000).
[9] Hansmann & Kraakman, at 390.
[10] *Dallah Real Estate* para 8, note 1; See, e.g., Mark Hager, Bodies Politic: The Progressive History of Organizational 'Real Entity' Theory, 50 u. Pitt. L. Rev. 575, 575-77 (1989).
[11] See, e.g. Michael C. Jensen & William H. Meckling, Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure, 3 J. FIN. ECON. 305, 311 (1976).
[12] Victor Morawetz, *A Treatise on the Law of Private Corporations* 2 (2d ed. Boston, Little, Brown and Co., 1886, 2009).
[13] Victor Morawetz, at 3.
[14] Gunther Teubner, Enterprise Corporatism: New Industrial Policy and the "Essence" of the Legal Person, 36 am. J. Comp. L. 130 (1988).
[15] See *Dallah Real Estate*, note 1; *Impregilo S.p.A*, note 30.
[16] *Kuwait v. X*, Swiss Federal Tribunal (24 January 1994). The case is unreported, but is partially reproduced at [1995] Rev. Suisse D. int. eur., Vol. 5, at p. 593.
[17] *Salomon v Salomon* [1897] AC 22.

just separated the incorporators and subscribers from company but also from its subsidiaries and holding companies. Frequently, reorganisation of corporate structure in corporate groups involves exclusion of especially risky activities in selected subsidiaries to shield the group as a whole from tort liabilities.[18] As Professor Blumberg put it, in such business planning, traditional entity law is being utilised to attempt to create a safe harbour for corporate groups seeking to externalise the costs of a subsidiary's negligence in conducting highly risky activities.[19] Similarly, very often purpose of incorporation of state-owned entities is to reduce the risk of reimbursements from the sovereign asset in case of entities' foreign debt. The principles of state sovereignty and political territoriality make separation of assets even more attractive.

The commercial world regards the principle of separation of legal identity and liability between different companies and entities as a universal legal assumption. All legal systems of major industrial countries recognise this principle.[20] The development of sophisticated multinational corporate structures was a response to various commercial factors, such as business expansion and diversification, the need for specialisation and efficient productive processes, raising capital finance, or reducing taxation liabilities. The invention of the concept of independent state-owned corporation is another development to that extent in support of advanced cross-border trade practice participated by the state. Almost every sovereign state has incorporated independent state-owned entity or sovereign wealth funds to serve sovereign commercial conducts. Almost 77 percent of the world's oil reserves are held by national oil companies with no private equity, and there are 13 SOCs with more reserves than ExxonMobil, the largest multinational oil company.[21]

3 Whether State can be a Party to the Arbitration Agreement of its entity

As discussed above the rationale behind the incorporation of a state-entity separate from the state itself is basically to limit the involvement and attribution of the state in case of any probable foreign debt incurred mostly out of investment agreement. Often it has been argued whether a state can be a party to the arbitration agreement with private corporations or a foreign investor in the first place. The following discussion of this paper will investigate the principle of state privity in the arbitration agreement of a state entity.

Most of the states have incorporated state entities for the purpose of serving governmental service or activates, often dealing with foreign investors in matter relating to the operation of national interest.[22] Consequently, policy issues and operational matters concerning foreign investments or investments in general are not handled by the relevant state departments or ministries but independent state corporations or sometimes they are known as sovereign wealth funds. However, these entities are most of the time substantially controlled by the relevant state departments or ministries. The position within the hierarchy of the government

[18] See, e.g. Richard Rothman, A Veiled Threat: Minimizing Parental Liability for U.S. Subsidiaries, Practical Law Company, August 23, 2007.
[19] Phillip Blumberg, *The Law of Corporate groups: Tort, Contract, and Other Common Law Problems in the Substantive Law of Parent and Subsidiary Corporations* (Little, Brown and Co. 1987).
[20] Gower and Davies, p. 193; OECD, 'Responsibility of Parent Companies for Their Subsidiaries' pp. 6, 24 (1980).
[21] Tina Rosenberg, The Perils of Petrocracy, N.Y. Times Magazine, Nov. 4, 2007, at 42; See International Working Group of Sovereign Wealth Funds; Generally Accepted Principles and Practices (Santiago Principles) (October 2008), available at http://www.iwg-swf.org/pubs/eng/santiagoprinciples.pdf.
[22] See creation of EPIDC and WAPDA by the Government of Pakistan, *Société* des *Grands Travaux de Marseille* (SGTM) *v. Bangladesh* 5 Y.B Com. Arb (1980) 217*;* ICSID Case No. ARB/03/3, *Impregilo S.p.A. v. Islamic Republic of Pakistan*, Decision on jurisdiction, 22 April 2005, para. 199.

and the degree of legal independence of these entities varies. The reasons for the establishment of these separate legal entities by the government are primarily specialisation and efficiency.[23] Thus, when a sovereign state needs to coordinating and giving a unified direction to any particular scheme, e.g. the development of schemes in Water and Power Sectors by the respective Electricity and Irrigation Department of the Provinces, states establish such para-statal entities. WAPDA, the Pakistan Water and Power Development Authority, was created in 1958 as a Semi-Autonomous Body for the purpose of coordinating and giving a unified direction to the development of schemes in Water and Power Sectors, which were previously being dealt with, by the respective Electricity and Irrigation Department of the Provinces. [24]

Incorporation of these state entities in relation to the foreign investment must be reconciled with the international principle of the unity of the state. This has raised the issue of attribution of acts of these entities to the state which are not restricted to the field of foreign investment. Domestic classification may not be decisive in this context. This question form part of general international law, and plays a significant role in matter relating to state responsibility. In relation to foreign investment, matters of attributions have most often come up on the side of the respondent state when a state argues that acts by state entities cannot be attributed to the state. However, the issue may also be relevant for a claimant when a respondent state considers a state entity single economic unit rather than a national of another state. [25] Therefore, conduct of a state entity to be attributed to the state needs further scrutiny about the negotiations and the directive mind of the state entity in its functional process.

4 Negotiation and Directive Mind of Contract for the State entity

The reasonable questions that need to be answered include who negotiate the investment agreement of state entities? Who has the *de facto* and *de jure* authority and directive mind to sign the agreement, in certain cases approval of financial securities? To illustrate, a businessman might actively negotiate a purchase agreement containing an arbitration clause, but at the last minute arrange for it to be signed by a company incorporated, owned and controlled by him. An application to extend the arbitration clause to the businessman could find support in the notion that buyer and seller intended the businessman to be a party to the agreement.[26] Similarly, investment agreements of most state entities are negotiated by the members of the government, often relevant ministers. Sometimes they are also signed by the members of government who is also the head of the state entity.[27]

In *Wintershall A.G., et al. v Government of Qatar*[28]the claimant and respondent entered into thirty years Exploration and Production Sharing Agreement (EPSA) in the offshore of Qatar on 1976. Under the agreement, government of Qatar granted exclusive right to explore, drill and produce petroleum in the defined offshore area. Due to the boundary dispute between

[23] See Rudolf Dolzer and Schreuer, Chap. 8 at 195; See also, in general, Organisation for Economic Cooperation and Development (OECD), Public Sector Modernisation: Changing Organisational Structures, OECD Policy Brief (2004).
[24] *See Impregilo S.p.A.*, para. 199; *See also* WAPDA, Available at http://www.wapda.gov.pk/htmls/auth-index.html.
[25] *CSOB v. Slovakia*, Decision on Jurisdiction, 24 May 1999, 14 ICSID Review Foreign Investment Law Journal 251, 268-271 (1999).
[26] William W. Park, 'Non-Signatories and International Contracts: An Arbitrator's Dilemma' (Oxford 2009) Multiple Parties in International Arbitration'p.1.
[27] *Kuwait v. X*, Swiss Federal Tribunal (24 January 1994); See also *Wintershall A.G*; *Dallah Real Estate*, note 1; *Southern Pacific Properties* (Middle East) *Limited v. Arab Republic of Egypt* (ICSID Case No. ARB/84/3), Decision on Jurisdiction, 14 April 1988.
[28] *Wintershall A.G., et al. v Government of Qatar*, Partial Award on liability of 5ht February 1988, 28 ILM 795 (1989).

Qatar and Bahrain, the claimant was not permitted to drill in the area where petroleum rights were held under the authority of Qatar general petroleum corporation (QGPC). QGPC was a corporation incorporated and wholly owned by the respondent and the Minister of Finance and Petroleum is the Chairman of its Board of Directors.

The negotiations for the future dealing were unsuccessful. The claimants referred the dispute to arbitration, alleging the respondent breached the agreement in violation of law of Qatar and customary international law by denying claimants permission to explore in contractual area. The tribunal held that QGPC was acting as an agent of the Government of Qatar and, therefore, all actions attributed to the QGPC in this case shall be attributed to the Government. The tribunal did not in any respect deny that QGPC was created as a separate independent legal personality under national law of Qatar. However, in the event at issue in this arbitration, QGPC acted as an agent or an arm of the Government in all proceedings relevant to the tribunal's jurisdiction. The tribunal in this case had taken into consideration the functional control of the Government over its entity to be attributed to the state for the responsibility of its entity.

Perhaps the most striking facts supporting the identity of the QGPC and the Government in the event at issue in this arbitration, was that "The Board of Directors of QGPC were appointed by the Emir and consists of 7 to 11 members, the majority of whom are officials of the Department of Petroleum Affairs of the Government. They can be removed at any time by Emir at his will. The Minister of Finance and Petroleum is the Chairman of the Bard". Based on the submissions by claimants the arbitral tribunal is in agreement that as a matter of the domestic law of Qatar it is clear that QGPC is a separate legal entity but it operates as an arm or agent of the Government in respect of the concession areas held by it.[29]

A contrary decision can be seen in the case of In *Impregilo S.p.A. v. Islamic Republic of Pakistan*[30] in which the important issue before the ICSID tribunal was to determine the status of state entity WAPDA and its relation with the government. While examining the status of WAPDA, the involved independent State entity, the Tribunal, at the outset, noted that its examination would be conducted in accordance with the applicable internal law of Pakistan. The tribunal noted that status of state entity WAPDA as a party to the Contracts is a matter for the national legislation of Pakistan, being both the law by which WAPDA was established and exists, and also the law governing the Contracts.' To establish this contention the Tribunal then proceeded to perform some jurisprudential tests in accordance with the applicable domestic law of Pakistan in order to determine the status of the state entity WAPDA.

The ICSID tribunal adopted the criteria of whether the state practiced any structural control over the state entity WAPDA which means, did the government of Pakistan have the power to appoint any of its officials or not. The Tribunal found that the entity consists of a Chairman, and not more than three Members appointed by the Government required by Section 4 of the 1958 Act.[31] They "receive such salary and allowances" and are "subject to such conditions of service as may be prescribed by the Government" according to Section 5 of the said Act. Moreover, under Section 6 of the Act, the Government may remove the Chairman and any Member of the Board for various reasons, in particular if they become, in the opinion of the

[29] *Wintershall A.G.*, paragraph 13 Chapter XI.
[30] ICSID Case No. ARB/03/3, *Impregilo S.p.A. v. Islamic Republic of Pakistan*, Decision on jurisdiction, 22 April 2005, para. 199.
[31] Section 4 of the 1958 Act of Pakistan.

Government, incapable of discharging their responsibilities under the Act or if they have been declared to be disqualified for employment in, or have been dismissed from, the service of Pakistan.'[32]

Further, the arbitral tribunal examined the status of the service personnel of the state entity WAPDA in order to determine whether working for the entity would constitute as working for the government of Pakistan or not. Based on the service structure of the entity the tribunal reached conclusion that 'Service under the Authority is considered to be service of the government of Pakistan, and every person holding a post under the Authority, not being a person who is on delegation to the authority from any Province, shall be deemed to be a civil servant for the purposes of the Service Tribunals Act, 1973[33] and within the meaning of Section 21 of the Pakistan Penal Code (Section 19(1)).' The Tribunal also adopted the criterion of functional control over the entity whether Pakistan practiced any functional control in WAPDA or not. The tribunal found that 'The power and duties of the Authority are defined in Sections 8 to 16 of the Act. Under Section 8, the Authority "shall prepare, for the approval of the Government a comprehensive plan for the development and utilization of the Water and Power resources of Pakistan". It also may frame schemes for a province or any part thereof, subject here again to approval by the Government.'[34]

Having examined the above two criteria the tribunal finally examined whether Pakistan practiced any financial control over the entity or not. The tribunal found that 'the accounts of the Authority are audited by the Auditor General of state of Pakistan annually. The Auditor Reports with the comments of the Authority are sent to the Government and the Authority "shall carry out any directive issued by the Government for rectification of an audit objection". Each year, the Authority submits to the Government for approval a statement of the estimated receipts and expenditures in respect of the next financial year according to Section 27 of the Act.' After performing all the aforementioned tests the tribunal concluded that 'Although the Government of Pakistan exercises a strict control on its entity WAPDA, in light of the terms of the 1958 Act that established it, WAPDA is properly characterised as an autonomous corporate body, legally and financially distinct from the state of Pakistan.'[35] According to the tribunal's view much of Impregilo's argument on this issue rested upon international law principles of state responsibility and attribution.

However, in the event at issue the tribunal has drawn a distinction between the responsibility of a State for the conduct of an entity that violates international law in this case breach of Treaty, and the responsibility of a State for the conduct of an entity that breaches a municipal law contract that is Impregilo's Contract Claims. To support its view the tribunal borrowed the principle from *Compañia de Aguas del Aconquija and Vivendi Universal v. Argentine Republic*, decided by *ad hoc* arbitration tribunal.[36] It seems the tribunal was reluctant to consider the matter of involvement of Government in the state-entity which consists of a chairman and three members appointed by the Government and may be removed by the government who are the civil servant of Pakistan. Moreover, the power and duties of the authority is subject to the approval of Government and the financial matter is strictly monitored by the Government of Pakistan. Therefore, in the event at issue in this arbitration it

[32] Impregilo S.p.A., para. 202, note 30.
[33] Sec. 17 (1)(d) of the Service Tribunal Act, 1973 of Pakistan.
[34] Impregilo S.p.A., para. 204, note 30.
[35] Impregilo S.p.A., para. 209, note 30.
[36] *Compania de Aguas del Aconquija SA and Vivendi Universal* (formerly Compagnie Générale des Eaux) *v. Argentine Republic*, ICSID Case No. ARB/97/3, Decision on Annulment of 3 July 2002, 6 ICSID Reports 340, para.96.

might be concluded that WAPDA was working as an agent or arm of the government to extend the corporate veil to the point which the ICSID tribunal disregarded.

In relation to the above example of businessman, assume, however, that the businessman played no role in the contract negotiation and performance, but misappropriated corporate assets for personal use. If the corporation becomes insolvent for misappropriation of corporate assets by the incorporator, an arbitrator might feel justified in looking beyond the corporation to its owner, irrespective of what the parties had originally intended. For jurisdictional purposes, the corporation would simply cease to exist, leaving the businessman to inherit the arbitration clause.[37] To its further extent, the businessman actively negotiated the contract and the agreement was signed by the corporation wholly-owned and controlled by him. The utilised the assets of the corporation for distinct purposes or responsibility for any unusual circumstances which caused the corporation to go bankrupt. An arbitrator might also feel justified to extend the scope of arbitration agreement beyond the corporate veil. Likewise, state entities that are incorporated and wholly-owned and controlled by the state and utilise its dividends and assets to public sectors according to the will of the government or responsibility for any unforeseen circumstances for loss of its entity arbitrators will not be reluctant to lift the corporate veil.[38]

5 Piercing Corporate Veil in International Investment Arbitration

In breach of an agreement by a state entity to be attributed to the state, corporate veil must be pierced in between state and its entity. In that context, piercing the corporate veil does not involve bringing in the state in arbitral proceedings that has not signed an arbitration agreement, but its entity. This issue may arise among the parent companies, subsidiaries, private individuals, governmental and quasigovernmental entities, and states. To decide about the status of the state entity or a corporation in a particular dispute, arbitral tribunals usually rely upon the domestic law. It is to be noted that there is no uniformity regarding the principle of piercing the corporate veil across national legal systems. It is not unusual that the approaches of tribunals in investment arbitration also vary.

Piercing corporate veil may be invoked to rationalise either jurisdiction over a corporate affiliate or a company's liability for the substantive debts of another.[39] Even with respect to subsidiaries of foreign entities, American principles can apply to jurisdictional determinations. In *Taca International Airlines v. Rolls Royce of England*, a New York court took jurisdiction over a British company on the basis that its Delaware subsidiary was "a mere department" of its ultimate parent.[40] It can also be extended to sovereign state for the liability of its entity or to the state entity for the debts of its parent state. This does not mean, however, that arbitrators who join a non-signatory parent must or should find the shareholder liable for the subsidiary's obligations. On occasion, joinder might be justified on the basis of consent, as when a parent agrees to be bound in an arbitration based on contracts signed by its subsidiary.[41] Even though both entities have agreed to subject themselves to the same arbitral proceeding, the arbitrator might determine that neither company is liable for the other's

[37] William W. Park, supra note 56.
[38] See *Wintershall, A.G. v. Government of Qatar*, Partial Award of 5 February 1988 and Final Award of 31 May 1988, 28 I.L.M. 795 (1989*); Dallah Real Estate* note 1*; Impregilo S.p.A*, note 30.
[39] See Phillip Blumberg, Kurt Strasser, Nicholas Georgakopoulos, & Eric Gouvin, Blumberg on Corporate Groups ch. 6 (*Aspen Publishers,* 2d ed. 2005); Phillip I. Blumberg, The Multinational Challenge to Corporation Law pp. 78–96 (1993).
[40] *Taca International Airlines v. Rolls Royce of England*, 15 N.Y. 2d 97, 102 (1965).
[41] *Fluor Daniel Intercontinental, Inc. v. General Electric Co*., Inc No. 98-Civ. 7181 (WHP), 1999 WL 637236 (S.D.N.Y. 1999).

obligations. Conversely, one company might be liable for another's obligations, without necessarily subjecting itself to the same dispute resolution mechanism as contained in the primary obligation.

In the matter relating to piercing the corporate veil, usually, arbitral tribunal differentiate between "consenting non-signatories" to arbitration agreements that seek to arbitrate the dispute, and "non-consenting non-signatories" that challenge the jurisdiction of arbitral tribunal.[42] Arbitral tribunals that pierce the corporate veil of non-signatories resort either to implied consent or intention of the parties.[43] There is no clear line between these two justifications, however, as tribunals often pierce the corporate veil as a means to enforce the parties' original intention. The most popular case as regard to piercing the corporate veil is the *Dow Chemical Award* decided by International Chamber of Commerce in which consenting non-signatories were allowed to participate in the arbitration proceedings.[44] In this case, applying group of companies' doctrine, the tribunal allowed parent companies to bring claim on behalf of its subsidiary.

In *Dow Chemical,* the tribunal relied on the common intention of the parties which appears from the surrounding circumstances that leads to the conclusion of tribunals reasoning to pierce the corporate veil. The tribunal also followed trade usages conforming to the needs of international trade, particularly in relation to the group of companies' doctrine.[45] According to the single entity theory applied by the tribunal, a group of companies, despite the legal status of each of the companies, represents a single economic reality which the arbitral tribunal must take into account when ruling on its jurisdiction.[46] However, application of the "group of companies" doctrine remains uncommon. Some authorities suggest only one out of probably every four cases that purport to apply the "group of companies" doctrine did actually extend jurisdiction over non-signatories.[47] In a contract of state entity the doctrine can be extended to the non-signatory state to make it a party to the arbitration agreement of its entity if it can be circumstantiated that the entity was working as an agent or arm of the government.[48]

When it comes to the matter relating to arbitration between foreign investors and host state under bilateral investment treaties, the legal scholars stand in different opinion. It has been suggested that the rules relevant to shareholder claims under investment protection treaties need to be regarded as *lex specialis* as established by specific treaties.[49] This is despite the fact that under the national law of most jurisdictions, shareholders are not allowed to bring claims on behalf of the company in which they own shares.[50] Therefore, shareholders are deprived of their legal rights to bring claim under domestic law as they are not party to the arbitration agreement. As a result, the insertion of shareholdings into the definition of investment in a bilateral investment treaty would generally result in piercing the corporate veil for the benefit of the shareholder in investment arbitration. For instance, Article 1(6) of

[42] See William W. Park, Non-Signatories and the New York Convention, 2 J. DISP. RESOL. INT'L 84, 105 (2008).
[43] William W. Park, at 107.
[44] William W. Park, at 103 (citing *Dow Chemical v. Isover St. Gobain*, ICC Case No. 4131, 1983 J. Dr. Int'l 899 (1932)).
[45] William W. Park, p. 103.
[46] Interim Award of September 23, 1982 in No.4131 (original in French), reprinted in IX ICCA Yearbook of Commercial Arbitration 131, 134 (1984).
[47] W. Park, supra note 28, at 106-07 (citing jean-francois poudret & sebastien besson, droit compare de l'arbitrage international pp. 253-54 (2d ed. 2007)).
[48] See *Wintershall A.G., et al.*
[49] Abbey Cohen Smutny, Claims of Shareholders in International Investment Law, in International Investment Law For The 21st Century: Essays In Honour Of Christoph Schreuer 363 (Christina Binder et al. eds., 2009).
[50] See OECD, supra note 20.

the Energy Treaty Charter provides that "Investment" protected by the Charter includes "a company or business enterprise, or shares, stock, or other forms of equity participation in a company or business enterprise, and bonds and other debt of a company or business enterprise." [51]

A typical case of piercing corporate veil could be where an incorporator sets up an undercapitalised corporation to incur liabilities to a third party. In most cases this happens when the corporation does not have enough assets to repay its debt, and the controlling incorporator relies on the concept of limited liability to avoid personal liability. Consequently, third party ends up bearing the risk of the non-payment of the debt.[52] In such situations, the court or arbitration tribunal may intervene to prevent such injustice and pierce the corporate veil by holding the controlling incorporator, majority shareholder-incorporator or wholly-owned state liable for its entities.[53] Piercing the corporate veil in case of state entities as discussed earlier depend on the involvement of Government in the entities' structure and function and control. If it is found *prima facie* that the state-entity is working as an arm or agent of the Government to serve public and commercial activities the tribunal may find it justified to extend the corporate veil beyond the structure of the corporation.

In the United States a question relating to piercing corporate the veil was first raised in the case of *First National City Bank v. Banco Para El Comercio Exterior de Cuba*[54], whether a foreign state can be held responsible for the actions or obligations of its subsidiary, or vice versa. The issue arose in this case with respect to execution or attachment, where the plaintiff sought to enforce a judgment against a foreign state by executing against the assets of the state's subsidiary. The issue would also exist where a plaintiff seeks to impute the commercial activity of a state entity to the parent government for the purposes of establishing an exception to sovereign immunity. This case established a rebuttable presumption that "state entities or instrumentalities incorporated as juridical entities distinct and independent from their sovereign state should normally be treated as such." In explaining this general rule, the Court referred to the legislative history of the 1976 Act which states "Section 1610(b) will not permit execution against the property of one agency or instrumentality to satisfy a judgment against another, unrelated agency or instrumentality. There are compelling reasons for this. If U.S. law did not respect the separate juridical identities of different agencies or instrumentalities, it might encourage foreign jurisdictions to disregard the juridical divisions between different U.S. corporations or between a U.S. corporation and its independent subsidiary."[55]

The Court then stated that the presumption of separate legal personality can be rebutted upon showing either that the "corporate entity is so extensively controlled by its owner that a relationship of principal and agent is created" i.e., the parent is an alter ego of the corporation; or recognition of the separate corporate status "would work fraud or injustice" on the other party. It should be noted that, following amendments to the FSIA in January 2008, principle of Bancec case does not apply to execution or attachment in terrorism cases. Rather, in cases falling under Section 1605A of the FSIA, "the property of an agency or instrumentality of a foreign state that is a judgment debtor for a claim based upon acts of terrorism, including

[51] Art. 1(6) of the Energy Charter Treaty, Dec. 17, 1994, 34 I.L.M. 360 (1995).
[52] *Lee Buchheit et al*., The Dilemma of Odious Debts, 56 Duke l. J. 1201, 1248 (2007).
[53] *Lee Buchheit, at al.,*1248.
[54] *First National City Bank v. Banco Para El Comercio Exterior de Cuba*, 462 U.S. 611 (1983).
[55] Sec. 1610 (b) Foreign Sovereign Immunities Act 1976 (quoting H.R. REP. NO. 94-1487, at 29-30 (1976), as reprinted in 1976 U.S.C.C.A.N. 6604, 6628-29).

property that is a separate juridical entity or is an interest held directly or indirectly in a separate juridical entity, is subject to attachment in aid of execution." [56]

Under the principal-agent exception, a court will typically pierce the corporate veil only where it is established that the parent exercises day-to-day operational control over the subsidiary.[57] Time has probably changed to disregard this kind of control that any sole shareholder would normally exercise over its subsidiary is insufficient to justify piercing the veil.[58] Under the fraud or injustice exception, courts apply a fact specific analysis to determine whether recognition of separate legal status would be unfair. Typically such cases involve the foreign state's manipulation of the corporate form for its own benefit, to the detriment of the plaintiff. In relation to the function of a state entity, if such situation arises, the arbitral tribunals or domestic court may extend the corporate veil for the attribution of state for the conduct of its entity.

7 Conclusion

In most of the investment arbitration where the state incurs liability for the agreement of its entities to foreign investors and the arbitral tribunal awards damages for the favour of foreign investors, states argue based on the separate legal personality of its entities that it is not a party to the arbitration agreement of its entities. Based on the above discussions in this paper it is pretty obvious that the negotiators and the directive mind of the state entities in their agreement with foreign investors are the government itself. State practice suggests that the government, specifically the relevant ministry, has structural and functional control over the state entities and the entities serve the governmental functions by the name of independent legal entity.

At the end of this incursion into a domain that requires further expansion of the corporate veil to cover the rationale behind the incorporation of a state entity and the purpose they serve towards establishing justice and equity ultimate goal behind the incorporation of a state entity by the state is to conduct commercial activities on behalf of the state under the banner of separate legal personality to limit the state liabilities for any foreign debt. This paper suggests that if it is to be found that the nature of the conduct of a state entity is as such that would have been otherwise performed by the state in the absence of the entity in question the corporate veil shall be disregarded and the incorporator state is to be considered party to the agreement.

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[57] *Mc Kesson Corp. v. Islamic Republic of Iran*, 52 F.3d 346, 352 (D.C. Cir. 1995); *U.S. Fid. & Guar. Co. v. Braspetro Oil Servs. Co., No. 97 CIV. 6124(JGK), 1999. WL 307666, at *9 (S.D.N.Y. May 17, 1999); U.S. Fid. & Guar. Co. v. Petroleo Brasieiro S.A.*- Petrobras, No. 98 CIV. 3099(JGK), 1999 WL 307642 (S.D.N.Y. May 17, 1999).
[58] *Flatow v. Islamic Republic of Iran*, 308 F.3d 1065, 1073 (9th Cir. 2002); *Minpeco, S.A. v. Hunt*, 686 F. Supp. 427, 435-36 (S.D.N.Y. 1988).

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Statutory Adjudication in Australia: Analysis of Adjudication Activity in New South Wales

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Abstract:
The *Building and Construction Industry Security of Payment Act 1999* (NSW) (the NSW Act) is a unique form of statutory regulation for the building and construction industry, which gives virtually all industry participants a statutory right to, and a means of recovering, payments for work done under a construction contract. The research aim is to examine current trends in adjudication applications and determinations under the NSW Act. The data used for this study was the collected by the NSW Department of Finance & Services as part of a regular reporting régime for the period from 1 July 2011 to 31 March 2012. In general, adjudication under the NSW Act is being well utilised by stakeholders in the NSW construction industry as a means of payment recovery. Claimants are highly successful at adjudication in terms of the proportion of the claimed amount they are awarded by adjudicators, particularly in relation to small value claims (i.e., claims less than $40,000). There has been a significant decrease over time in the incidence of adjudication applications being reported as 'completed but not determined'. Currently, a much greater proportion of adjudication applications lodged with Authorised Nominating Authorities (ANA) are proceeding to determination than in previous years.

Keywords:
Adjudication, activity, New South Wales, security of payment.

1 Introduction

This paper reports on an on-going research project being undertaken by the authors' into the performance of the *Building and Construction Industry Security of Payment Act 1999* (NSW) (hereafter referred to as 'the NSW Act').[1]

The NSW Act commenced in March 2000 and was introduced as part of the New South Wales Government's policy to eradicate the practice of developers and contractors arbitrarily delaying payment to subcontractors and suppliers in the NSW building and construction industry (Iemma, 1999). The NSW Act was the first comprehensive legislative scheme to be introduced in Australia to provide, *inter alia*, contractors, subcontractors and building professionals with a statutory right to, and a procedure to recover, progress payments. While it embraces the philosophy of rapid 'statutory adjudication' of payment claim disputes introduced in the UK[2], the NSW Act is substantially different in its structure and operation from its UK counterpart. Similar legislative schemes to that operating in NSW and the UK

[1] New South Wales (abbreviated as 'NSW') is one of six states of the Commonwealth of Australia.
[2] *Housing Grants, Construction and Regeneration Act 1996* (UK) pt. 2.

have since been introduced in all Australian states and territories[3], New Zealand[4], Singapore[5] and the Isle of Man.[6] On March 8 2011, the Irish Construction Contracts Bill 2010 was passed by the upper house of the Irish Parliament. At the time of writing, the Malaysian Building and Construction Industry Payments and Adjudication Act remains pending.

'Statutory adjudication' is a process defined in the NSW Act of referring a payment claim dispute to an independent third party known as 'adjudicator'. Whenever a claimant[7] endorses a payment claim as a claim made under the NSW Act, the claimant may elect to have the payment claim adjudicated upon under the NSW Act if the respondent[8] withholds payment.

The NSW Act has undergone two significant amendments since its introduction – the first in 2002[9] and second in 2010.[10] Accordingly, 'the NSW Act' referred to here is the NSW Act as amended.

This paper will be concerned with the NSW Act only. The aim of the research was to examine adjudication activity under the NSW Act between 1 July 2011 and 31 March 2012. In particular, the trend in the number of adjudication applications and adjudication determinations as well as the success of claimants at adjudication made will be examined. Apart from improving security of payment, the NSW Act also intends to provide a fast and relatively inexpensive mechanism for deciding (on an interim basis) payment claims disputes. Consequently, the researchers attempt to ascertain any trends in the cost of adjudication.

The results of this research may be of interest in other jurisdictions where statutory adjudication for the construction industry has been introduced or is being contemplated.

2 Security of Payment

In the context of this paper, 'security of payment' is a generic term used to describe (NSW Government, 1996:41):

> [T]he entitlement of contractors, subcontractors, consultants or suppliers in the contractual chain to receive payment due under the terms of their contract from the party higher in the chain.

Thus, the security of payment problem refers to (Commonwealth of Australia 2002:7):

> [The] consistent failure in the building and construction industry to ensure that participants are paid in full and on time for the work they have done, even though they have a contractual right to be paid.

The security of payment problem has been an ongoing issue for those who carry out construction work, or supply related goods and services under a construction contract (Commonwealth of Australia, 2002).

[3] *Building and Construction Industry Security of Payment Act 2002* (Vic); *Building and Construction Industry Payments Act 2004* (QLD); *Construction Contracts Act 2004* (WA); *Construction Contracts (Security of Payments) Act 2004* (NT); *Building and Construction Industry Security of Payment Act 2009* (Tas); *Building and Construction Industry (Security of Payment) Act 2009* (ACT); *Building and Construction Industry Security of Payment Act 2009* (SA).

[4] *Construction Contracts Act 2002* (NZ).

[5] *Building and Construction Security of Payments Act 2004* (Singapore).

[6] *Construction Contracts Act 2004* (Isle of Man).

[7] The 'claimant' is the person *by whom* a payment claim is served – *see: Building and Construction Industry Security of Payment Act 1999* (NSW) ss. 4, 13.

[8] The 'respondent' is the person *on whom* a payment claim is served – *see: Building and Construction Industry Security of Payment Act 1999* (NSW) ss. 4, 13.

[9] *Building and Construction Industry Security of Payment Amendment Act 2002* (NSW).

[10] *Building and Construction Industry Security of Payment Amendment Act 2010* (NSW).

In sum, the security of payment problem is the result of the practice by principals and contractors in the construction industry of unduly delaying and devaluing progress payments owed to subcontractors for work done under construction contracts. The tactic of principals and contractors in delaying payments or unduly reducing the value of payments is largely designed to enhance their positive cash flow at the expense of subcontractors (Brand and Davenport, 2011).

The security of payment problem has long been a major source of commercial hardship for those operating in the construction industry, particularly for the many small and often undercapitalised firms, which operate at or near the bottom of the contractual chain (Iemma, 1999). It is suggested that, but for the systemically poor payment behaviour of principals and contractors, the problems of commercial hardship and failure amongst small firms in the construction industry would largely be avoided. Furthermore, one must not overlook the potential for the unnecessary generation of societal problems that often accompanies commercial hardship and failure (Commonwealth of Australia, 2002).

The next sections of the paper describe the research method adopted for this study, followed by a synthesis and analysis of the data. Conclusive remarks are then presented.

3 Research method

The operation of the security of payment legislation in NSW is facilitated by Authorised Nominating Authorities (ANAs). At the time of writhing, a total of nine such ANAs were operating in NSW. Their function is to accept adjudication applications, refer adjudication applications to adjudicators and issue, upon request, an adjudication certificate.[11] Furthermore, each ANA is required by the NSW Department of Finance & Services (hereafter referred to as the Department) to report regularly on a variety of matters relating to adjudication applications and determinations made in NSW. Reporting is required by the Department with a view of allowing it to "better monitor trends in adjudication" (NSW Department of Commerce, 2004:6).

Data used for this research was the adjudication activity data published by the Department as part of the aforementioned reporting régime. The adjudication activity data used for this research covers the period from 1 July 2011 to 31 March 2012 (NSW Department of Finance & Services, 2012).

It should be noted that, at the time of writing, no aggregated adjudication activity data have been published by the Department for the full period covering 3 March 2003 (i.e., the date of commencement of the 2002 Amendment Act) to 31 March 2012. Brand and Uher (2005) and Brand and Uher (2007) have previously reported on their analysis of the aggregated adjudication activity data published by the Department (then known as the NSW Department of Commerce) for the period covering 3 March 2003 to 30 June 2006. At the time of writing, the Department had not published any adjudication activity data for the period from 1 July 2006 to 30 June 2011.

The data published by the Department is not aggregated according to the participating ANAs. The format of the data used in this study has ruled out a statistical analysis. Instead, the authors' attempted to subjectively interpret trends emerging from the data and, where appropriate, relate them to the findings derived by the authors in their previous research into the performance of the adjudication process in NSW.

[11] 'Adjudication certificate' means a certificate provided by an Authorised Nominating Authority under the *Building and Construction Industry Security of Payment Act 1999* (NSW), s. 24.

4 Adjudication Applications

4.1 Number and statues of applications

For the period from 1 July 2011 to 31 March 2012, the total number of adjudication applications lodged with ANAs was 842 (see Table 1 below). The total value claimed for the period is in the order of 188 million AUD. The highest and lowest claimed amount for the period is 20.7 million AUD and 420 AUD respectively.

Table 1: Number and status of adjudication applications

Status	Number (% of Total)
Applications lodged	842 (100%)
Determination released	544 (64.6)
Determination pending release	200 (23.8)
Applications completed but not determined†	98 (11.6)

†'Applications completed but not determined' are application where no determination has been released by the adjudicator and no determination is pending release. In such cases, the adjudication process has come to a premature end between lodgement of the application with the ANA and a determination being made by the adjudicator.

From Table 1 above, it is can be seen that, of the total number of completed adjudication applications lodged with ANAs, 544 (or about 65 percent of the total number of application lodged) determinations had been released to the parties. At the time of writing, about 24 percent of the total number of completed adjudication applications were either pending determination by the adjudicator or pending release to the parties. About 12 % of the total completed adjudication applications were classified as 'completed but not determined'.

Whilst the Department does not indicate the reasons for an application being 'completed but not determined', Brand and Uher (2005) and Brand and Uher (2007) report that this is most likely to arise under two following conditions: (1) when the parties settle the dispute and withdraw the application before a determination is made by the adjudicator; and (2) when an adjudicator, after accepting the adjudication application, subsequently decides that the adjudicator lacks the jurisdiction to determine the application and subsequently withdraws their acceptance of the application before making a determination. Brand and Uher (2007) report that the first and second condition arises in about 37% and 45% of all cases, respectively. Similar results are reported by Brand and Uher (2005). Further study is needed to confirm if the two stated conditions still account for the majority of applications being classified as 'completed but not determined'. At the time of writing, there were no reported studies to indicate that there has been any shift in this regard.

Interestingly, Brand and Uher (2005) and Brand and Uher (2007) both report that about one-quarter of all adjudication applications lodged with ANA's were classified as 'completed but not determined'. As already stated, the Department's adjudication activity data for the period commencing 1 July 2011 to 31 March 2012 indicates that only about 12% of all applications lodged with ANAs were 'completed but not determined'. The results suggest that a much greater proportion of adjudication applications lodged with ANAs for the period 1 July 2011 to 31 March 2012 are being determined than for the periods between 3 March 2003 to 31 August 2004 and 3 March 2003 to 30 June 2006. The reasons for this apparent shift are unclear. Whilst further study is needed to confirm the extent of this apparent shift, it is suggest (based on the preceding paragraphs) that it may have two likely causes; firstly, that over time, the parties have been less inclined to settle payment disputes once the adjudication process has commenced; or secondly, that over time, adjudicators have been less frequently deciding that they lack jurisdiction to determine adjudication applications. Of course, the apparent shift may be the result of a combination of these factors.

4.2 Applications lodged

Section 14(1) of the Act provides that the respondent may reply to a payment claim by providing a 'payment schedule' to the claimant. A payment schedule is, in effect, a notice that must be served on a claimant if the respondent does not intend to pay the whole of the claimed amount by the due date for payment.[12] If the respondent fails to provide a payment schedule within the time allowed under the Act, the respondent becomes liable to pay the claimed amount to the claimant on the due date for payment.

A claimant may lodge an adjudication application under one of the following sections of the Act only: s.17(1)(a)(i); s.17(1)(a)(ii); or s.17(1)(b). Firstly, where respondent provides a payment schedule for less than the full amount claimed, and the claimant does not accept the lesser amount, the claimant is entitled to lodge an adjudication application with an ANA under section 17(1)(a)(i) of the Act. Secondly, where respondent provides a payment schedule for the full amount claimed but fails to pay the whole (or any part) of the scheduled amount by the due date for payment, the claimant is entitled to lodge an adjudication application with an ANA under section 17(1)(a)(ii) of the Act. Similarly, where respondent provides a payment schedule for less that the full amount claimed, and the claimant accepts the lesser amount, but the respondent fails to pay that amount by the due date for payment, the claimant is entitled to lodge an adjudication application with an ANA under section 17(1)(a)(ii) of the Act. Finally, where a respondent fails to provide an payment schedule and fails to pay the claimed amount by the due date for payment, the claimant is entitled to lodge an adjudication application with an ANA under section 17(1)(b) of the Act. It should be noted that if an adjudication application is intended to be lodged under section 17(1)(b) of the Act, and the respondent fails to provide a payment schedule in response to the payment claim, section 17(2) of the Act requires the claimant to give the respondent written notification of the claimant's intention to apply for adjudication under the Act. This notification, in effect, gives the respondent a second opportunity to provide a payment schedule to the claimant in response to the payment claim. The distribution of applications lodged (by section of the Act) for the period from 1 July 2011 to 31 March 2012 is shown in Table 2 below.

Table 2: Adjudication applications lodged (by section of the Act)

Section	Number (% of Total)
17(1)(a)(i)	482 (57.2%)
17(1)(a)(ii)	16 (1.9%)
17(1)(b)	344 (40.8%)
Total	842 (100%)

Table 2 shows that in the majority of cases (about 60 percent) respondents elect to provide a payment schedule in direct response to a payment claim. Whilst a significant minority of respondents (about 40 percent) elected not to provide a payment schedule in direct response to the payment claim, it is unclear what proportion of these respondents elected to provide a payment schedule in reply to the written notification made under section 17(2) of the Act. On that basis, no conclusions can be drawn as to whether there is, perhaps, an intention by these respondent to simply ignore payment claims in order to delay or escape payment, or whether these respondents are seeking to legitimately delay the provision of a payment schedule to the claimant and so make use of the additional time allowed under the NSW Act

[12] See: *Building and Construction Industry Security of Payment Act 1999* (NSW), s. 11(1).

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to prepare the payment schedule.[13] Considering the time the Act has been in operation, and the consequences under the NSW Act for not providing a payment schedule, it is reasonable to conclude that the latter reason is the more likely.

5 Adjudication Determinations

For the period from 1 July 2011 to 31 March 2012, the Department reports that 544 determinations have been released to the parties in NSW. The highest and lowest adjudicated amount for the period is not reported by the Department. The number of adjudication applications (determination release) by payment claim value range is shown in Figure 1.

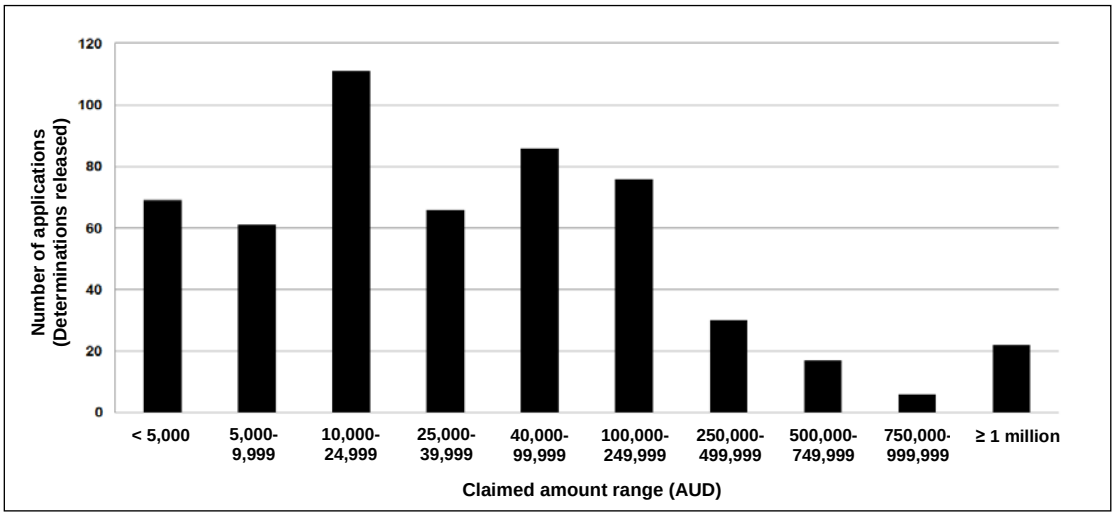

Figure 1: Frequency of claimed amount (by claim range).

Figure 1 shows that payment claims between < $5,000 to just under $250,000 tend to be the most frequent claimed amount values with a notable decline in the frequency of claimed amount values $250,000 and above. Claimed amount values of $250,000 and above represent about 14% of the total number applications lodged with ANAs. The most frequently determined payment claims were those of the amount between $10,000–$24,000 and $40,000–$99,000. This result is consistent with the results given in Brand and Uher (2005) and Brand and Uher (2007). Furthermore, a factor to be considered in determining the level of success of claimants at adjudication is the frequency of favourable outcomes experienced by claimants at adjudication. Figure 2 below shows the overall comparative values of the total claimed and adjudicated amounts for the period.

[13] Respondent is given an opportunity to provide a payment schedule within 5 business days after receiving the claimant's notice.

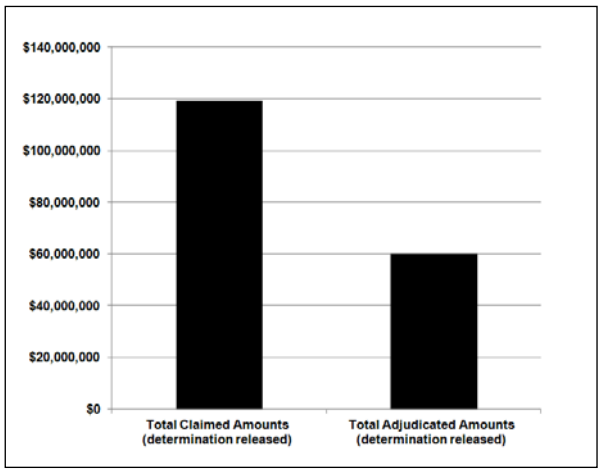

Figure 2: Total claimed and adjudicated amounts

Figure 2 shows that of the total number determinations released (i.e., 544), the total value of claimed amounts was 119.2 million AUD with a total value of adjudicated amounts being 60.1 million AUD. The results show that adjudicators, overall, award claimants about 50 percent of the clamed amount. This indicates that claimants' tend to have only modest success at adjudication in terms of the proportion of the claimed amount awarded by adjudicators. However, when examined across the spectrum of claim values, it is apparent that the level of success of claimants at adjudication varies considerably. This is shown in Table 3 below.

Table 3: Average claimed and determined amounts (by claim range)

Range of Claim Values ($)	No.	Average Claimed	Average Determined (% Av. Claimed)	No. awarded 100% (% of No.)
< 5,000	69	$2,618	$2,371 (91%)	49 (71%)
5,000 - 9,999	61	$7,357	$6,570 (89%)	42 (69%)
10,000 - 24,999	111	$15,919	$14,732 (93%)	70 (63%)
25,000 - 39,999	66	$32,415	$28,253 (87%)	37 (56%)
40,000 - 99,999	86	$66,804	$53,160 (80%)	37 (43%)
100,000 - 249,999	76	$159,470	$121,112 (76%)	28 (37%)
250,000 - 499,999	30	$358,365	$193,660 (54%)	6 (20%)
500,000 - 749,999	17	$584,337	$168,946 (29%)	0 (0%)
750,000 - 999,999	6	$924,850	$553,667 (60%)	0 (0%)
≥ 1,000,000	22	$3,207,742	$1,372,085 (43%)	0 (0%)
Total	544			

Table 3 shows that, in the case of small value claims (i.e., claims less than $40,000), adjudicators award, on average, about 89% of the claimed amount with claimants being awarded the whole of the claimed amount in about 65% of cases. In the case of medium value claims (i.e., claims from $40,000 to less than $250,000), adjudicators award, on average, about 77% of the claimed amount with claimants being awarded the whole of the claimed amount in about 40% of cases. Finally, in the case of large value claims (i.e., claims greater than $250,000), adjudicators award, on average, about 45% of the claimed amount with claimants being awarded the whole of the claimed amount in about 8% of cases. The results indicate that claimants making small to medium value claims (i.e., claims less than $250,000) are notably more successful at adjudication than those making large value claims, both in terms of the average proportion of the clamed amount awarded by adjudicators and the proportion of instances where the adjudicator awards the full amount claimed.

It is not clear to what extent (if any) the provision of a payment schedule impacts on the level of success of claimants at adjudication in terms of the average proportion of the clamed amount awarded by adjudicators and the proportion of instances where the adjudicator

awards the full amount claimed. However, Brand and Uher (2007) report that, generally, claimants' success at adjudication declines sharply when respondents' provide a payment schedule. To what extent this holds true across the spectrum of claim ranges is unknown. Further research is required in relation to these issues.

The reasons for claimants having less success at adjudication when adjudication involves large claims, rather than small to medium size claims, is also unclear. Brand and Uher (2007) contend that, generally, parties to large payment claim disputes are frequently assisted by lawyers or claim consultants at adjudication and that the relatively small return to claimants in the case of large payment claims appears to support the view that large payment claims tend to be overinflated. Through the author's direct involvement in the adjudication process in NSW, it is apparent that respondents, generally, do not defend small payment claims by employing lawyers or claim consultants in preparing payment schedules and adjudication responses. Similarly, claimants tend not to employ to lawyers or claim consultants in preparing payment claims and adjudication applications. One reason why respondent's may not engage lawyers or claim consultants in such cases is that respondents do not regard the overinflation of small payment claims as an issue of chief concern. Further research is required on this issue.

6 Cost of adjudication

One of the most important aims of the adjudication process is to provide claimants with a relatively inexpensive method of having disputes as to payment determined by a neutral adjudicator (Iemma, 1999). The distribution of the average total direct fees (i.e., the fees of the ANA and the fees and expenses of the adjudicator) for all adjudication determinations released in NSW for the period from 1 July 2011 to 31 March 2012 is given in Table 4 below.

Table 4: Adjudication fees (by claim range)

Claimed Amount	No.	Av. Fees ($)			Av. Fees (%)		
($)		Total	Respondent Share	Claimant Share	Total[1]	Respondent Share[2]	Claimant Share[3]
<5,000	69	570	545	25	21.8%	95.7%	4.3%
5,000-9,999	61	900	827	74	12.2%	91.8%	8.2%
10,000-24,999	111	1,249	1,193	56	7.8%	95.5%	4.5%
25,000-39,999	66	2,244	2,101	143	6.9%	93.6%	6.4%
40,000-99,999	86	2,937	2,575	362	4.4%	87.7%	12.3%
100,000-249,999	76	5,445	4,854	591	3.4%	89.1%	10.9%
250,000-499,999	30	8,353	6,181	2,172	2.3%	74.0%	26.0%
500,000-749,999	17	10,399	6,545	3,854	1.8%	62.9%	37.1%
750,000-999,999	6	15,553	12,960	2,592	1.7%	83.3%	16.7%
≥ 1,000,000	22	19,132	13,740	5,392	0.6%	71.8%	28.2%
Total number	544						

[1] Av. Total Adjudication Fee expressed as a percentage of the Av. Claimed Amount (Av. Claimed Amount is shown in Table 3 above). See Fig. 3 below.
[2] Av. Respondent share expressed as a percentage of the Av. Total Adjudication Fee.
[3] Av. Claimant share expressed as a percentage of the Av. Total Adjudication Fee.

The Department's data does not indicate under what circumstances claimants' are required to pay adjudication fees. Under the NSW Act, adjudicators have the discretion to determine the proportion of the adjudication fees each party is required to pay. Uher and Brand (2007) and Uher and Brand (2005) report that when adjudicators award a $nil to claimants, they are generally required to pay 100 percent of the adjudication fees. However, in the remainder of cases, the amount of the adjudication fee that claimants' are required to pay will vary.

Nevertheless, Table 4 above indicates that respondents are generally required to pay the greater proportion of the adjudication fees across the spectrum of claim values. Figure 3 below shows that there is an inverse relationship between the amount claimed and the total adjudication fee when expressed as a percentage of the amount claimed.

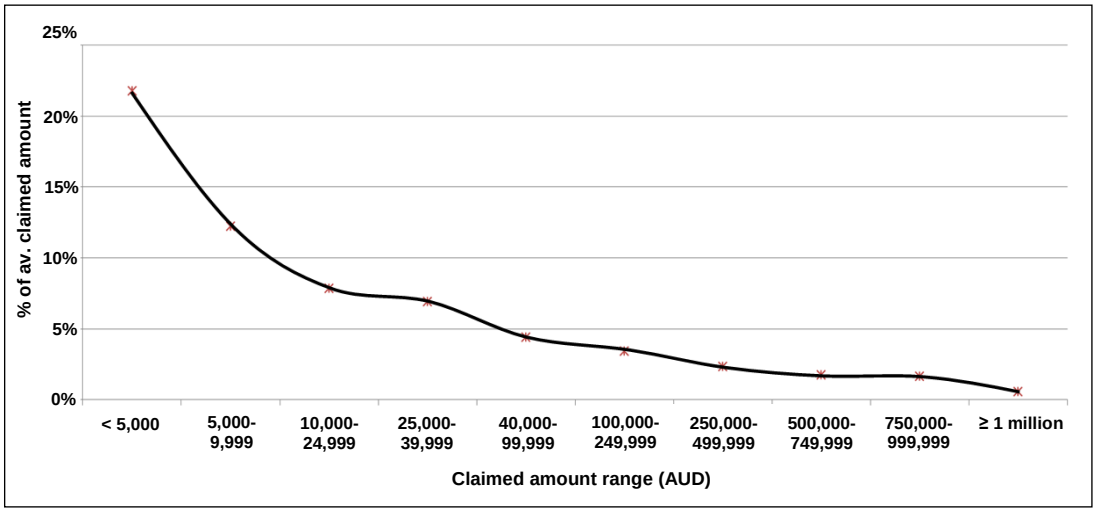

Figure 3: Av. total adjudication fee expressed as % of the av. claimed amount (by claim range).

It is interesting to note that, in relation to small payment claims (i.e., claims less than $40,000), the total adjudication fee equates, on average, to only about 12 percent of the total claimed amount. This increases to a maximum of about 22 percent for the claims of less than $5,000 down to a minimum of about 7% for claims between $25,000 to less than $40,000.

Compared to other forms of dispute resolution, such as arbitration and litigation, which are processes acknowledged as being costly (Carter *et. al.,* 2007), adjudication appears to have provided a financially viable option for those making small claims to have the dispute heard and determined by an independent third party. This conclusion is supported by the data in Table 4 above, which shows that just over half of the applications lodged with ANAs for the period were made in relation to small value claims.

7 Conclusion

The foregoing discussion of the data collected by the Department shows that, in general, adjudication is being highly utilised by stakeholders in the NSW construction industry as a means of payment recovery. The data reveals that claimants are highly successful at adjudication in terms of the proportion of the claimed amount they are awarded by adjudicators, particularly in relation to small value claims.

Adjudication fees appear to be modest enough to conclude that adjudication provides claimants with a relatively inexpensive means of determining disputes as to payment by an independent third party. The results indicate that adjudication is providing a financially viable option for those making small claims to have the dispute heard and determined by an independent third party. This result appears to justify the introduction of the NSW Act as a means of assisting smaller firms in the NSW construction industry to recover payment, and suggests that the aim of the NSW Act is being achieved.

The results suggest that there has been a significant decrease over time in the incidence of adjudication applications being reported by ANAs as ‘completed but not determined’. Whilst

further study is needed to confirm the extent of this apparent shift, the result suggest that the parties' have been less inclined to settle payment disputes once adjudication has commenced and/or adjudicators have been less inclined to find that they lack the requisite jurisdiction to determine adjudication applications.

Whatever the reasons for this apparent trend are, the consequence is that, currently, a much greater proportion of adjudication applications lodged with ANAs proceed to determination than in the periods between 3 March 2003 to 31 August 2004 and 3 March 2003 to 30 June 2006.

Participation by respondents in the adjudication process tends to be moderate, with only about 60 percent of respondents providing a payment schedule in direct response to a payment claim. However, the Department does not report on the number of respondents' that elect to provide a payment schedule in reply to the written notification under section 17(2) of the NSW Act. On that basis, the level of participation of respondents' in the adjudication process is arguably higher than the Department's data suggests.

8 Acknowledgements

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Towards the Sustainable Development of Chinese Construction Labour Market

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Abstract:
This research is to identify the root cause for Chinese construction labour problems that might exist in subcontracting systems. It also explores potential economic incentives of tentative adjustments of subcontracting systems on subcontractors (SCs) for achieving sustainable employment improvement. The research examined the failure of recently promoted schemes in improving construction labour market in China. The causal analyses were done based on empirical observations of one representative construction general contractor (GC) in China. The failure of new schemes is due to ignorance of continuing development of SCs under existing subcontracting systems. With excessive competition by Cost-Based-Selection, and restrictions on subcontracting scope and layer, current systems fail to provide economic incentives for SCs' good performance. Japanese experience demonstrates the significance of facilitating SCs' development for efficient production and employment improvement. Furthermore, long term relationship (LTR) under Affiliated Companies by giant Japanese GCs is found to be indispensable for SCs' ongoing development. Under today's business environment with various uncertainties in China (e.g. workflow unreliability), enlarging subcontracting scope and layer, and promoting LTR amid construction supply chain are mathematically validated to have potential economic incentives for SCs' continuing development. It could ultimately lead to the realization of sustainable Chinese construction labour market.

Keywords:
Chinese construction, economic incentive, migrant labour, subcontracting, uncertainty.

1 Introduction

The functioning of construction industry consists of two aspects in most countries. Those are its contribution to the development of national economy and people's standard living, and its role in absorbing labour force. Experiences of many countries show that construction industry provides much needed employment for a large number of the poorer and less well educated labourers of the society. Regarding the labour market, there are basically three involved issues as the source of labour, the basis on which it is employed and the way it is treated (Wells, 2003). On the one hand, those issues have profound implications for project objectives, productivity, and skill development that are usually to be the immediate concern of construction industry

stakeholders. On the other hand, such issues as the number of jobs, the systems under which construction labourers are employed and managed, as well as their conditions can affect the achievement of social objectives such as the alleviation of poverty and the promotion of social stability and harmony. Therefore, studies of construction labour market should be of high priority from both economic and social views.

The Chinese construction has so far enjoyed a good opportunity for development, which has already been a leading contributor to the Chinese national economy. It has provided enormous employment for labour force as well, especially for those surplus rural labourers called 'migrant labourers' in China. However, the Chinese construction has recently been in a dilemma with an increasing labour outsourcing practice for construction production. It brings about widespread and increasing labour rights infringements, such as ignorance of occupational health and safety, payment default or wage squeeze, long working hours, instability of job or employment, lack of job training, few social securities, domestic problems due to separation from their families, etc. Those labour issues result in a negative image of the Chinese construction industry universally. It greatly hinders the recruitment and retention of construction labourers in recently China, especially among the growing new generation of migrant labourers. Construction industry employers in China seem too much lag behind other industries in how they conduct their people practices. This industrial gap must be closed; otherwise the recruitment and retention of construction employees will become chronic problems in the near future (Charles, 2007). Even worse, many grave social problems will be brought about. Those explanations argue that the future of Chinese construction calls for more labour-oriented strategies. To be more detailed, it is urgent for Chinese construction not only to pay close attention to improve current employment situation, but to raise the issue how to foster a sustainable construction labour market as a vital element to its future development. It is certainly a complicated and systematic task to be carefully tackled, since any frequently changeable or short-sighted interventions or regulations would not only make the existing problems unresolved but in turn bring new fatal problems and even aggravate the tension between construction enterprises and its labour force. The focus of this study is to explore labour-based strategies and adaptable measures for an economically effective and socially responsible Chinese construction.

2 Observations on Recent Chinese Construction Labour Market

China is a typical country in that most construction labourers are migrants from the rural areas, called 'migrant labourers'. They occupy more than 80% of construction workers on sites. The priority for them is to get work on a regular basis and improve income.

2.1 Corporatization among Informal '*Baogongtou*'

Recent studies in China described the central role of labour contractor, known locally as '*baogongtou*', who is head of the working team with labourers usually coming from the same rural area. *Baogongtou* exerts profound influences on the labour subcontracting business and the lives of construction workers. Through joining an informal team headed by a *baogongtou*, the labourers are provided with an opportunity to obtain work and acquire skills, which could bring them a higher income in a sense. However, this opportunity is mostly denied to those without family and social connections with

baogongtou. Thus, it is regarded as a barrier to training and innovation. Even worse, since labour subcontracting is prone to decreasing the level of upper contractor's control on labour force, it has a great potential of labour exploitation. It does take place in recent China. Those labour issues have been universally reported with an indiscriminate blame on *baogongtou*. As a result, *baogongtou* is generally considered to have negative connotations in China, which precipitated the government to prohibit informal *baogongtou* and promote formal labour subcontracting enterprise (LSE) as a substitute since 2005. However, the applicability and effectiveness of this enforcement may be reserved for further consideration in view of unsatisfactory progress in practice. During the investigation into one representative general contractor in China, those interviewed project managers admit that 'illegal' *baogongtou* remains to abound on sites in disguise since it is preferable to LSE in labour subcontracting business. The direct cause lies in the principle of Cost-Based-Selection under current competitive labour subcontracting market. It makes the informal *baogongtou* with lower labour cost by evading the overhead costs and on-costs of formal employment beat the competition. So LSEs are usually exposed to a vitally disadvantageous position in the business competition. That may explain the dumping of LSEs that depresses labour cost to an unreasonable degree just for getting jobs and survival. It is likely to bring about problems of quality, safety, labour issues, etc., and hinder the continuing development of LSEs themselves. The root cause may exist in subcontracting systems with excessive restriction on subcontracting layer and business scope (An, 2010). It ignores the potential of labour subcontractors to become a speciality one or even higher level amid the construction supply chain to a great extent. Regarding the limitation on business scope to labour-only for labour contractors, as most of them are small and medium-sized, it is harder for them to cope with various uncertainties inherent in today's business environment. In a word, under current excessively restricted and competitive subcontracting market, there is little economic incentive to promote corporatization among labour contractors. As a matter of course, LSEs have not matched the expectations in term of development. Furthermore, there becomes a huge imbalance in the numbers of general contractors, speciality subcontractors, and labour subcontractors. This is unlike normal construction industrial structure (Li et al, 2010). Up till now, general contractors complain that subcontracting market is too disordered and deficient in supplying qualified subcontractors with labour and specialist skills; meanwhile, *baogongtou* as well as LSE complain they could not see any promising future in today's insecure business environment. Thus, fundamental improvement of labourers' situation has not been achieved. Policies and regulations may need to be reassessed and adjusted. Instead of compulsive enforcement by administration, more efforts should be made to understand their economic behaviours.

2.2 Direct Control by General Contractor

Efforts have been made in many countries to overcome the disadvantages of labour subcontracting. Regarding the loss of control over the labour force and site work, one common practice is that general contractor adopts an arrangement whereby the labour is sourced through a labour contractor but paid and supervised on its own. It has also been promoted by the Ministry of Railways in China since 2005 in view of undying practice of multi-layer subcontracting. Through that, even when risk is passed down to the labour contractor with a fixed sum paid for a package of work, the site manager employed by the general contractor can still exercise a considerable degree of control.

Bresnan (1985) argues that it could be enhanced further through the use of known subcontractors with whom general contractor has a longstanding relationship, or through the employment of speciality subcontractors. It points out promising directions of system adjustment for current Chinese construction. As is acknowledged, direct control by general contractor is supposed to be a transitional mode seen from the development of construction industry in most developed countries. Along with the growth of general contractors who will gradually develop their capabilities for undertaking EPC or DB projects, concrete engineering works are usually subcontracted or sub-subcontracted to speciality subcontractors that are small-scaled but with highly specialized construction skills or technologies. Thus subcontractors should be cultivated and stimulated with more initiatives on developing their specialist skills and management capabilities to achieve more efficient construction production. Based on that, the conditions of construction labourers largely recruited and employed by subcontractors may achieve a fundamental and sustainable improvement. However, the significance of subcontractors has not been realized or truly understood in the competitive and risk transfer work culture amid construction supply chain in China.

2.3 Contractual Work Relations

Recent Chinese government thinks that one of the most important solutions of labour issues is labour contract, revealed by the promotion of LSE which is ought to sign a contract with labourers. It is believed that if there is labour contract, the conditions of labour force would be much improved. Of course, contract has legislated constraints by law enforcement in labour users regarding formal payment and welfare systems; however, it should be on the premise of sound law systems and legal compliance that are far from sufficient in current China. Many cases in other countries indicate that there is usually a large gap between regulations in principle and action in practice, suggesting that contract may not solve the problems fundamentally. Actually, schemes for improving the labourers' situation including welfare have also been devised in other countries like Egypt, India, and Korea, based on the acknowledging of labourers' temporary or casual status. Most of those schemes illustrate that the policy direction should be moved to accommodate the needs of construction labourers without requiring a fundamental change in the way labourers are recruited and employed. It again argues that the rigid prohibition of *baogongtou* in China may be one-sided with little consideration of their further development, and ignorance on their functioning of building a social bond to some extent. Although the latter argument should not be carried too far, it is important to recognize *baogongtou*'s close relationship with groups of labourers. The key should be to facilitate their development in specialist skills and management capabilities. A valuable approach is non-contractual cooperative relationships like Japanese long term work relations up and down the construction supply chain. It has facilitated the further development of downstream subcontractors, and consequently established a highly specialized subcontracting market.

3 Hypotheses for Developing Future Construction Labour Market

From above, current interventions by government to deal with some negative impacts of 'informal' labour subcontracting may not have to totally deny it. One of the root causes may exist in the excessively competitive and restricted subcontracting systems which

ignore subcontractors' further development by failing to provide economic incentives for them. Actually, informal employment and multi-layer subcontracting systems (MLSS) have their rationalities of existence, particularly in developing countries (Assaad, 1993; Aelim, 2010). Those schemes have positive meanings for both industrial structure adjustment and improvement of construction labour employment. To overcome some negative repercussions of the schemes, one crucial issue is to facilitate subcontractors' continuing development. It calls for a truly mutual understanding between general contractors (GCs) and subcontractors (SCs) regarding labour subcontracting business. GCs must recognize the functional change brought by outsourcing or subcontracting, and then understand the significant role of SCs' development in their business. Further, economic incentives for SCs to develop their competencies should be explored through understanding the barriers they encounter in subcontracting business. Based on that, the deregulation or adjustment of subcontracting systems could exert an effect in practice. It then argues that releasing restrictions on subcontracting layer and business scope, and meanwhile introducing cooperative work relations between GC and some certain SCs into existing competitive mechanism, would foster qualified speciality SCs. It will finally lead to the realization of efficient and effective construction production systems with just-in-time and efficient assembler (GC) and qualified suppliers (SCs). The hypotheses stated above are shown briefly in Figure 1 aiming at the development of sustainable construction labour market in China.

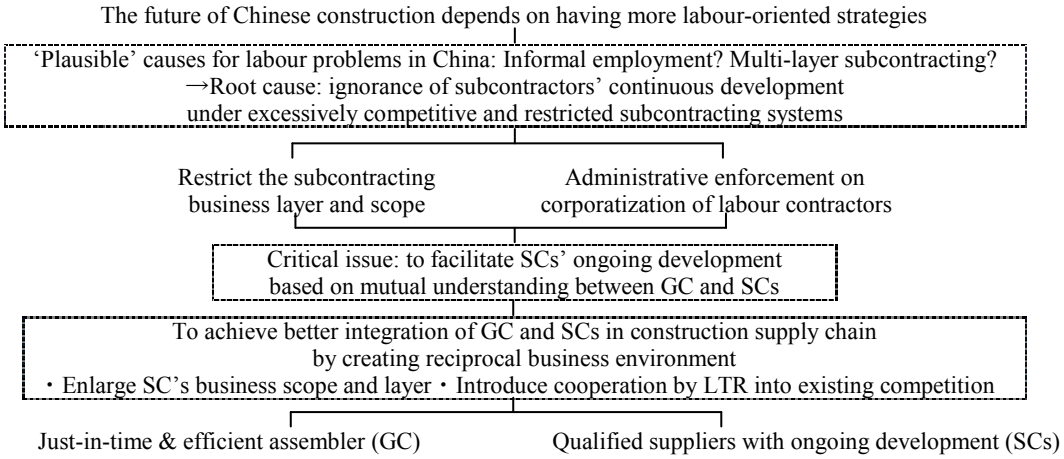

Figure 1. Hypotheses for developing sustainable construction labour market in China

4 Approaches for Exploring Economic Incentives

4.1 Japanese Experience on Fostering Subcontractors-Case of *Kajima*

Kajima is one of the Japan's big six construction general contractors, and the transition of relationships between *Kajima* and its subcontractors (see Figure 2), reveals a typical Japanese practice of facilitating the development of subcontracting market (Furukawa, 1963). In Japan, giant general contractors play a dominant role in fostering subcontractors' continuing development via establishing and developing its Affiliated Companies (ACs) among those subcontractors who enjoy long-term paternalistic but conclusive family work relations. This long term relationship (LTR) contributes to the achievement of efficiency and great success of the Japanese construction industry

(Bennett, et al. 1987). Generally speaking, within the construction industry, the value-added process is distributed across several organizations between GC and SCs. Without working together in a cooperative manner, supply chain efficiencies are difficult to realize. Through LTR under ACs mode, good integration between *Kajima* and its SCs in the construction supply chain is achieved. Regarding subcontractors' integrating process, foremen accumulated skills and technologies across the various projects that increase operational efficiency within the GC, which provided a high value to their business functioning. Their initial business with GC was to be an intra-company transaction, and then inter-companies transaction in the capacity of labour subcontractors with a construction corporative license. Afterwards, through becoming the Affiliated Companies of a certain GC, labour subcontractors got an opportunity to further develop their specialist skills as well as management capabilities in a secure business environment attributed to the long term working relationships. This opportunity facilitated them to be specialty subcontractors or even general contractors along with the business extension. Normally it at least takes a foreman at the bottom subcontracting layer 7-8 years to accumulate essential construction skills and management capabilities to become a specialty company in Japan. Thus it is inferred that gaining a regular work with the same contractor has a significant meaning in acquiring and accumulating skills or technologies that are essential for ongoing development of labour subcontractors, even though the whole process is generally informal and the time span of skill acquiring is varying. What's more, Japanese mode could decrease of uncertainty of transaction up and down the construction supply chain, and ensure labour subcontractors an economic incentive to further develop their specialist skills and management capabilities.

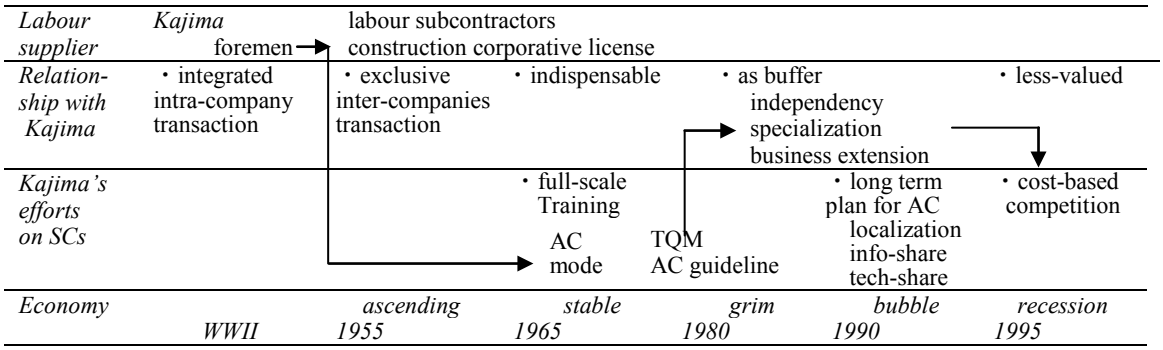

Figure 2. Transition of relationships between *Kajima* and its subcontractors within economy development

4.2 Mathematical Analyses on Potential Economic Incentives

As is known, LTR could reduce uncertainties to some extent. However, it is prone to adoption by SCs just as a short-term response to pressure from powerful clients or GCs, rather than a fundamental cultural change. Moreover, if it is not implemented properly, it could exert detrimental effects on SCs in turn (William, 2009). The real cultural change requires an understanding of factors that dictate the basic interests of the parties involved (Bresnen and Marshall, 2000). One great barrier for better integration of GC and SCs during construction process is workflow instability. SCs are generally fragile or vulnerable, since they are in the downstream of construction supply chain, and their further development is largely dependent on the fundamental accumulation on projects level as mentioned above. Furthermore, it is prone to arbitrary use and exploitation of

labourers by SCs as a buffer or leverage to cope with fluctuation of work. Thus striving for stable work flow is a basic interest for involved parties. Instead of conventional risk transfer that could not eliminate potential waste or loss brought by workflow instability, risk sharing under LTR and business scope enlarging might be better ways.

Given that the contract price between client and GC is reasonable enough so that GC does not have to worry about its payment by client, but is just concerned with how to complete project work efficiently with well coordination by SC. Stability of workflow is then mainly influenced by the degree of work plan reliability by GC, and reliability in providing necessary resources by SC. Derived from Sacks (2004), SC's net income could be expressed as $I = Total\ Income - Total\ Cost = min\{k, q\}W_D(U - C_M) - kW_DC_S$. Here, $k=R_A/R_D$, in which R_A denotes the actual resources provided by SC, and R_D is the quantity of resources demanded by GC to complete the planned work; $q=W_A/W_D$, where W_A denotes the quantity of actual work made available, and W_D is the quantity of work demanded. Figure 3 shows the relations between SC's net income (I), resource allocating strategy (k), and GC's plan reliability (q). In this scenario, SC could set the value of k to optimize its net income as its resource allocating strategy.

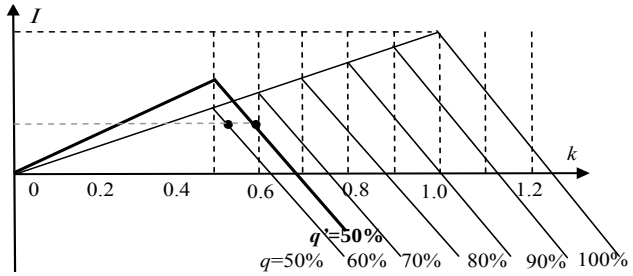

Figure 3. Relations between SC's net income, resource allocating strategy and GC's plan reliability

As can be seen, SC's net income is dependent on the reliability of work plan by GC (q), resulting in SC's different behaviours when providing resource (k). As q declines, not only SC's expected income will be reduced, but the loss is more easily incurred. It could explain that SC is liable to providing fewer resources than demanded if the work plan is less reliable. From SC's perspective, non-trust work relations will lead to its behaviour like not to be of honesty or integrity. It is consistent with the prior perception that SCs tend to provide fewer resources demanded by project managers, such as cheating on labour and materials (jerry building). For a rational SC, they must try to estimate the value of q, and then choose resource allocating strategy more appropriately (i.e. $k = q$) to maximize income. However, the actual value of q occurs with uncertainty $P_r(q)$ in practice. Since the value of q varies over the multiple planning periods, if a frequency distribution can be collected, then the expected value of q is possible to be estimated. It would be much valuable for SC, but it could only happen during a long term working period. In practice, even if SCs could not get access to the records of the value of q for each project, they usually have a mental impression of the plan reliability in each project. As can be inferred, under a stable working relation, this kind of estimation could be more accurate and beneficial for SCs to allocate resources appropriately.

Another interesting result is: the vulnerability of SC to the unreliability of work plan by GC could be influenced by subcontracting business scope. If SC supplies labour-only

(labour-only subcontractor), the slope (see the bold line in Figure 3) will become steeper. It means that SC becomes more vulnerable or sensitive to the degree of reliability of the work plan (q). On that occasion, with the same value of q, SC needs a bigger value of k to obtain the same profit. In other words, if the subcontractor supplies a significant proportion of the materials needed for the work, its vulnerability to work plan could be decreased. It is also consistent with prior knowledge that SC prefers subcontracting more services like materials and equipment, rather than labour-only. By doing that, SC could be less influenced by insecure business, and enjoy a higher potential to gain profit.

5 Conclusions

Regarding the underdeveloped Chinese construction labour market involving many labour issues, one of the root causes exists in the subcontracting systems. It ignores the continuing development of subcontractors with excessive competition by Cost-Based-Selection, and restrictions on subcontracting scope and layer.Japanese experience demonstrates the significance of facilitating SCs' development for efficient production and employment improvement in the long run.To facilitate SCs' ongoing development, enlarging subcontracting scope and layer, and promoting LTR amid construction supply chain are put forward. Those adjustments to current subcontracting systems have potential economic incentives for involved parties regarding the work plan and execution, which is a major concern in construction production. Hence, the proposals are believed to be able to motivate GC and SCs to become trustful partners amid construction supply chain, and realize sustainable employment improvement ultimately.

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ASSESSMENT OF RISK AND TECHNICAL CHALLENGES ASSOCIATED WITH BUILDING REFURBISHMENT SCHEMES

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ABSTRACT

It is common knowledge that aged buildings are constantly growing in number with a concomitant growing pressure to maintain their utilitarian values in the face of changing technology, legislation and sustainability issues. Wholesale demolition of these buildings can be unhealthy from an environmental protection perspective as it causes heavy pollution as well as placing more demand upon depleting resources. The need for alternative to demolition and new-build is therefore, imperative and the current problems in the economy appear to have moved building owners from demolition and new build to refurbishment. Although refurbishment may involve numerous cost saving opportunities, it may also involve substantial risks and challenges which can jeopardise the achievement of desired outcomes. The objective of the paper is to evaluate the types of risks that are associated with building refurbishment schemes. The research question is: What constitutes a risk in refurbishment schemes? The paper is based on a comprehensive literature review as part of on-going PhD research programme on risk structure in building refurbishment schemes. The paper establishes a consensus that refurbishment projects contain high risk than an equivalent new construction and that the impact of individual risk or a collection of risks may jeopardise the attainment of desired goals, hence risk assessment is imperative to enable successful implementation of the scheme.

Keywords: existing buildings, refurbishment schemes, risks.

INTRODUCTION

While building refurbishment may be perceived as a well-established alternative to demolition and new-build for many years, it is now more widely recognised that it makes far greater sense to retain and refurbish buildings in preference to demolishing and new-build (Corus, 2010; Gorse and Highfield, 2009; Marsh, 1983). Indeed, from an environmental protection perspective, recycling of buildings through refurbishment and retrofitting is ideal whereas wholesale demolition of buildings can be quite unhealthy as it causes heavy pollution as well as placing more demand upon depleting

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resources (Zavadskas et al, 1998). Corroborating these views, Marsh (1983) argued that tearing down every building that became older than 30 years is a sheer waste of economic resources. Furthermore, through reuse of old and aged buildings, less construction waste is generated and less material resources are required (Edward and Turret, 2000), and therefore beneficial to the environment.

According to Corus (2010) refurbishment presents a means of improving the value and performance of existing buildings without the economic and environmental costs associated with new-build construction. This view is endorsed by different researchers across the globe that a refurbished building can be as functionally efficient and can attain the same environmental sustainability as new-build (Corus, 2010; GVAGrimley, 2010; Mansfield, 2009; Gorse and Highfield, 2009; Marsh, 1983). However, despite such significance and growing awareness, there is nevertheless a widespread view among researchers that refurbishment projects generally contain more risk than new build (CIRIA, 1994; Reyers and Mansfield, 2001; Mansfield, 2009; Lam et al, 2010; Rahmat and Ali, 2010). Indeed, the scope and extent of refurbishment is wide, its definitions also changes with financial size of the project while its decision-making process is hampered by the lack of clear and consistent definition from relevant authorities (Reyers and Mansfield, 2001). This view suggests that refurbishment projects are more complex to design, implement and manage.

Apart from the normal problems associated with refurbishment schemes, developers are currently faced with challenges to comply with current legislation to minimise carbon emissions in buildings. The emergence of modern concepts of sustainable development has gained international recognition in recent years. A typical example of such concerns were deliberated at the United Nations conference on Environment and Development, Rio de Janeiro (1992) and 10 years later at the World summit on sustainable development, Johannesburg (2002). This arises mainly from growing concerns for the depletion of natural resources, climate change as well as environmental pollution.

These growing concerns have forced Governments worldwide to enact and promulgate laws in order to minimise the effects of carbon emissions in buildings. However, in the UK there is divergence of opinions which suggests that although this can be achieved, it will require concerted efforts to meet the current targets. Indeed, the Task Force on Sustainable Development (2007) indicates that in order to achieve the anticipated improvements needed to address the environmental impact of the built environment; the construction and property sectors must engage more meaningfully and become more pro-active with the sustainable development agenda within the next 15-20 years. This is due in part to the mere fact that the UK has some of the oldest building stock in Europe (Office of the Deputy Prime Minister-ODPM, 2005; National Refurbishment Council-NRC, 2010). Indeed, these buildings pre-date the emergence of modern concepts of sustainable development. Notwithstanding, the UK Green Building Council-UKGBC (2008) articulated that existing buildings still have an important role to play as nearly eighty per cent of the buildings that will be inhabited in 2050 are those already standing. Nevertheless, the ability to refurbish these buildings to current regulations and standards is a huge step towards the sustainability agenda. Thus, this clearly emphasises the significance of refurbishing and retrofitting existing buildings up to standard not only to meet carbon emission targets, but also to improve the general living conditions fit for the occupants.

However, compelling as the modern concepts of sustainable development may be, it is no doubt a huge challenge to developers and building landlords. The main concern is: with the current economic climate, how viable are the current government targets? Such questions may emerge because the UK has some of the oldest building stock. Notwithstanding the efforts of the national government to address the negative impacts of sustainable development; the technical and physical constraints of existing buildings present particular challenges for those trying to align with the sustainable criteria (Mansfield, 2009). Therefore, given the nature of refurbishment projects, where a combination of risks and unforeseen discovery may impact on the achievement of desired outcomes, developers will have to weigh the returns against the risks, hence, the assessment of risk and uncertainty is a key component of the schemes.

REFURBISHMENT: GENERAL PERSPECTIVE

Building refurbishment has become one of the most important sectors of the national construction programme in the UK. The sector is claimed to have grown rapidly, and has become an important economic driver (CIRIA, 1994) and it has been expanding in comparison to new development, hence, Kherun et al (2002), CCCIS (2005) and Gorse and Highfield (2009) claimed that almost 50% of the constructions activities undertaken in the UK were mainly maintenance and refurbishment.

A review of international literature suggests that refurbishment can avoid the wholesale waste of resources that comes about when older buildings are cleared to make way for new. Being essential from both economic and environmental perspectives, refurbishment can offer a cost-effective way to extend the economic life of a building (Mansfield, 2009). Through refurbishment, the replacement of old and outdated facilities to one that meets the current standards is optimally achieved. Refurbishment is also considered to be a quicker and lower cost means of extending the lifespan of existing buildings as well as reintroducing a building back into the market (GVAGrimley, 2010; Gorse and Highfield, 2009) as it is substantially cheaper than demolition and new-build. Nevertheless, the extent of deterioration of existing buildings should be investigated before any informed decision can be made whether they are worth refurbishing (Zavadskas *et al.*, 1998). Arguably, to achieve the desired outcome, there is need for tripartite cooperation between designers, contractors and building users.

Furthermore, there is a wide spread view among researchers that all development projects be it refurbishment or new-works have an important role to play in achieving the current government targets for sustainable development concepts; since the construction industry is better placed to implement sustainable practices than other industries (Rees, 1999). The Organisation of Economic Co-operation and Development-OECD (2004) suggests that the existing stock can be considered as an unexploited asset with great potential to improve the environment; hence, Rees (1999) opined that new construction must be limited in developed countries while concerted efforts should be directed towards refurbishing existing building stock. Indeed, Resource for Urban Design Innovation-RUDI (2009) claimed that refurbishing the existing building stock must be a priority if only the set targets for sustainable

development are to be achieved, thus building refurbishment has become an important part of the entire building and construction process.

THE NEED FOR EFFECTIVE RISK MANAGEMENT TECHNIQUE

It is often claimed that contracting in the construction industry is very competitive and highly risky. Generally, the construction industry can be viewed as a complex environment and its activities are inevitably full of risks whereas a construction project is typically organised by hierarchically linked parties who possess differentiated skills and knowledge. As a consequence, complex relationships exist within project teams that, if not managed effectively, can adversely affect a project's performance (Walker, 1995). In many instances the perception of conflicting objectives among the parties involved in a construction project leads to adversarial relationships. Indeed, it is impossible to eliminate all project risks in construction (Franks, 1998). Mansfield (2009) suggests that risk and uncertainty exist in all projects, irrespective of type, size or location thus, the management of risks must be optimised rather than ignored (Cost Engineer, 1993) because risk has become a commercial product that is identified, priced and responsibility legally attributed (Centre for Public Services, 2004).

Risk can therefore, be considered to be the possibility of a forecast variable (for example, refurbishment cost) being different from that at completion (Mansfield, 2009). Furthermore, it is often argued that the delivery process of building refurbishment projects is assumed to be full of risk. Like new construction project operation, refurbishment projects are also guided by three primary objectives. These are cost, time and quality and it is worth taking note that, each of the project objectives are usually associated with risk and uncertainty. Indeed, Reyers and Mansfield (2000), Rawlinson and Wilkes (2008) and GVAGrimley (2010) claimed that dealing with an existing building introduces many sources of risks and uncertainties which can affect the scope of work, the total cost and the time or schedules. It therefore comes as little surprise that there has been significant interest in the management of refurbishment schemes. In addition, there is a plethora of literature advancing the importance of risk management in construction projects; this has led to the development of different versions of guidance notes relating to risk management. This includes risk management guidance (DCMS, 2000) and risk management in housing (Housing Corporation, 2001).

The review of literature suggests that through risk management (RM) strategy, it is possible to minimise risks and uncertainties associated with development projects. Hillson (2003) has argued that RM is recognised as an essential tool to tackle the inevitable uncertainty and risk associated with projects, leading to an acceptable and manageable level of risk. He further suggest that projects still fail to meet their objectives and expected benefits, despite the theoretical principle that RM should contribute to project success. Nevertheless, in refurbishment, effective risk management strategy will still be required to ameliorate potential risks and uncertainties associated with refurbishment schemes.

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RISK ASSESSMENT IN BUILDING REFURBISHMENT SCHEMES

Risk assessment is considered to be the overall process of risk analysis and evaluation (Abd Karim et al, 2007). Indeed, managing refurbishment projects is faced with some unique problems in dealing with people, the environment and the project itself (Lam et al., 2010). In considering how complex and uncertain refurbishment can be, quite a number of remarkable studies on refurbishment highlighted that refurbishment projects generally contains high risk than new build (CIRIA, 1994; Reyers and Mansfield, 2001; Mansfield, 2009; Lam et al, 2010; Rahmat and Ali, 2010), due in part to the extent of deterioration which is hardly obvious at the outset of the project. They are also considered to be more difficult (CIRIA, 1994; Zavadskas et al. 1998; Rahmat and Ali, 2010), requires experience and capability (CIRIA, 1994; Zavadskas et al., 1998; Corus, 2010), more technical and economic uncertainties (Ali et al., 2010; Mansfield, 2008; Reyers and Mansfield, 2001; CIRIA, 1994), requires collaboration (CIRIA, 1994), fragmented and uncoordinated (Lam et al., 2010), thus, the complications experienced on new building projects doubles in refurbishment (Marsh, 1983; Abd Karim et al, 2007).

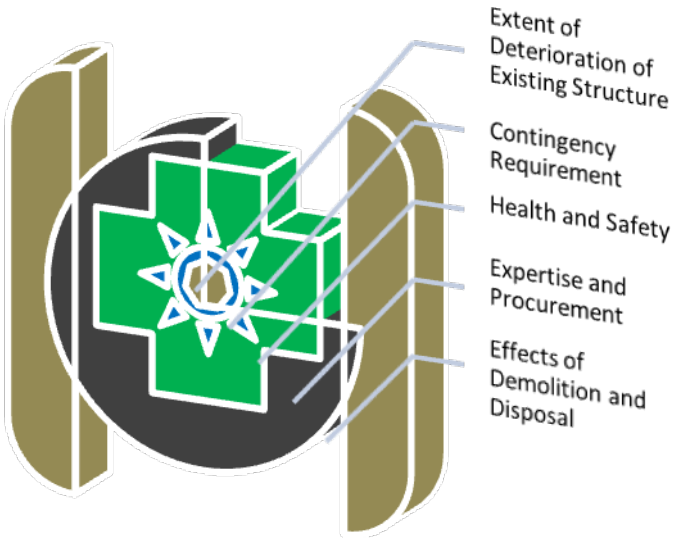

Fig. 1: Risks associated with Building Refurbishment Schemes

The aspect of risk and uncertainty associated with refurbishment may include the following:

- Lack of available information in relation to the building's original design and construction, including the existence of unrecorded alterations;
- The condition of the existing building such as the quality of original construction and the effects of wear and tear;
- The effects of demolition, alteration and temporary works on the progress of works and on the retained fabric and the removal and disposal of old materials;
- Higher level of contingency requirement for the increase risk of unforeseen costs associated with the schemes to deal with any unexpected difficulties;

- Health and Safety requirement for protection of workforce and surrounding buildings, the unexpected occurrence of hazardous materials such as asbestos and possibility of complex planning sequencing of construction programme, which may require expert risk assessment and management;
- The requirement for Expertise and Procurement to enable proper management and implementation of the schemes.

These areas of risks are summarised in figure 1 and presented as lack of information about original designs (CIRIA, 1994), issues on neighbouring buildings/party walls (Rawlinson and Wilkes, 2008; CIRIA, 1994), effects of demolition including disposal (Corus, 2010; Rawlinson and Wilkes, 2008), specialist expertise (CIRIA, 1994), the condition of existing structure (Rawlinson and Wilkes, 2008; GVAGrimley, 2010), building occupancy (CIRIA, 1994), health and safety issues (Corus, 2010; GVAGrimley, 2010; Highfield, 2000; Egbu, 1996; CIRIA, 1994), contingency requirement and procurement strategy (GVAGrimley, 2010), as well as the need to comply with statutory requirements (CIRIA, 1994; Highfield, 2000).

CONCLUSIONS

The review of international literature suggests that refurbishment projects contain more risk than new-build and indeed individual risk or a combination of the risks may jeopardise the achievement of desired outcomes. Literature also suggests that such risks in refurbishment can be managed and eliminated through the use of strategic risk management technique. The risk management technique allows the identification, assessment and proper management and implementation of the schemes successfully. However, to ameliorate such risks successfully, a tripartite cooperation is important between the designers, contractors and building users hence, risk assessment is an important part of the schemes.

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Barriers to the Last Planner® System of Production Control for Construction Projects

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Abstract:
Managing and controlling building processes to minimize waste has become a key concern for many contractors. To aid in the search for a more efficient and profitable business model, many contractors have embraced lean production philosophies. In doing so many contractors have adopted methods from the Lean Project Delivery System™ of Greg Howell and Glenn Ballard. This method has proven successful by lowering waste in construction processes, increasing profitability and improving workflow predictability. A key aspect of the Lean Project Delivery System™ is the Last Planner® System of production control – a method geared towards streamlining the workflow processes. Although the system has numerous reports of increasing project predictability and profitability, contractors are often frustrated when trying to implement the system. This study aims to identify key barriers encountered during the implementation process and evaluate common industry practices to overcome them. Although the lean transformation is becoming a mainstream goal for many organizations, a defined framework for Last Planner® implementation has not fully developed. This report will analyze a survey questionnaire sent to contractors implementing the Last Planner® System to develop an understanding of the barriers commonly faced and methods used to abate them. Conclusions and recommendations are provided in this report.

Keywords:
Barriers, Last Planner®, Lean, Production Control.

1 Introduction

Understanding the tools of lean construction, and how to evaluate a lean system is an important aspect of implementing lean in the construction process. With trying economic times across the globe, contractors have sought new ways to improve productivity and trim waste from construction processes. Seeking guidance from the manufacturing industry, principles from the Toyota Production System (TPS) have been studied extensively to understand how the system might be adopted for use in the construction industry. Lean manufacturing—the term synonymous with Toyota's manufacturing method is described as a way to design production systems to minimize waste of materials, time, and effort in order to generate the maximum possible value

(Koskela, 2002; Forbes & Ahmed, 2011). Put simply, the lean pursuit is one of maximizing value and minimizing waste for everyone involved. This report will try to evaluate these methods and the barriers that face contractors' adaption of the system.

The aim of this study is to glean an understanding of the current industry practices used to implement the Last Planner® System. To achieve this understanding this document will seek to:

- *Identify barriers commonly encountered by construction firms in their endeavour to improve workflow productivity and efficiency.*

Further, this study will critically analyze identified barriers in order to aid in the creation of an in depth implementation framework of the Last Planner® System.

1.1 Understanding Lean Construction

The pursuit of integrating Toyota's lean principles into the construction industry has proven quite difficult in an industry where variation is endless. Two men have made great strides in promoting the implementation of lean principles into construction management practices. Coining the term *"Lean Construction"*, Greg Howell and Glenn Ballard argue that implementing these policies is the next logical step in the evolution of the construction industry. Lean construction is the adoption of lean manufacturing principles and processes from the Toyota Production System (TPS) and making them applicable to the construction industry in hopes of removing waste from construction processes. Lean is a value seeking process that seeks to remove all activities that do not create value for which the customer is willing to pay (Howell & Ballard, 1998).

Understanding the key philosophy of lean construction is crucial to firms seeking to implement its principles in their organizations. The Construction Industry Institute (CII) identified five key lean construction principles in their Study PT 191 (Forbes & Ahmed, 2011):

- Customer Focus
- Culture and People
- Workplace organization and standardization
- Elimination of Waste
- Continuous improvement and built-in quality

These principles are identified as traits of a lean organization and should be the goal of firms seeking to become a lean organization.

Greg Howell and Glenn Ballard, co-founders of the Lean Construction Institute (LCI), assert that lean construction is an entirely new way to manage construction (Forbes & Ahmed, 2011). This new lean mindset led to the exploration of avenues in which to eliminate waste in the actual day-to-day management of construction.

Through the Lean Project Delivery System™ (LPDS), Howell expands the effort to eliminate waste in construction by outlining a process to conduct and manage construction projects. Treating construction as a kind of production, Howell and Ballard

seek to apply lean principles to the production processes. One key asset in this system is the Last Planner® System of Production Control in which lean principles are applied to the flow of work being put-in-place on construction projects.

The Last Planner® System (LPS) seeks to reorient the construction process from a push system, in which work is started based on the schedule—to a pull system where activities are started as prerequisite work is completed. The key aim in transforming the process is to eliminate wasteful variation and make construction a more predictable process (Elzarka, 2006). Studies show that there is less variance in cycles for a pull system than in an equivalent push system (Forbes & Ahmed, 2011). Eliminating variation allows the construction industry to move closer to the ideal manufacturing setting that companies like Toyota experience—where processes are repetitive and highly predictable.

1.2 Scope of the Study

The scope of this research is to evaluate current literature, publications and case studies in order to gain an in depth understanding of the barriers encountered by firms seeking to implement the LPS as a means for production control. Further, firms active with LCI will be surveyed, allowing for a more current understanding of what members in the industry are encountering and what methods are being used to overcome those conflicts.

1.3 Rationale for the Study

The Last Planner® System cannot be used as a stand-alone lean tool (Hamez & Bergstrom, 2010). Organizations should seek to deploy it as an extension of their lean initiative, specifically in the aim of eliminating waste and improving process efficiency. Research shows that when used in conjunction with other lean principles, the LPS can have a significant impact on operating profit (Howell & Ballard, 2003). Most of this increase is shown to come from decreased labor costs and savings on material waste. Therefore, the system is an attractive option for firms seeking new ways to increase profitability.

Even though there is a financial case for the system's implementation, many still lack the ability to utilize the system due to the unforeseen barriers and a lack of in-depth framework (Hamez, 2009). While many previous studies have focused on the positive outcomes of the LPS, an assessment of the current implementation of the LPS is needed to evaluate performance and suggest improvements.

2 Literature Review

2.1 Background

The lean principles found in the Last Planner® System can be traced back to Toyota's Engineer Taichi Ohno study of Henry Ford's business practices in the United States (Howell, 1999). Amazed by Ford's revolutionary production line, Ohno identified several ways in which the system could be improved with significant amounts of waste being eliminated. Ohno quickly returned to Japan and began the company's journey toward a movement that would revolutionize production around the world (Howell,

1999). As a result of this study, Toyota became a shining example of the benefits of lean production.

Research led by Greg Howell and Glenn Ballard pioneered new ways to apply Toyota's lean manufacturing principles to the construction industry with the goal of increasing stakeholder' value. Howell and Ballard created the Last Planner® System of Production Control as a means of controlling and planning the production processes on construction projects (Hamzeh & Bergstrom, 2010). However, despite a variety of success stories touted by the Lean Construction Institute (LCI) and the Construction Industry Institute (CII), widespread adoption of the system has still not occurred. One reason for slow adoption has been contractor's lack of awareness of the system and the overall lack of precedence within the industry. The necessary framework needed to implement such a system has yet to be fully established and tested (Hamez & Bergstrom, 2010), leaving contractors with high risk and limited historical data when facing barriers to implementation.

Therefore, as contractors strive to become lean organizations the LPS will continue to develop as a way to retool inefficient production processes. Developing a framework for successful implementation of the system will be predicated on encountering and overcoming obstacles to the system. An in-depth understanding of these potential conflicts is necessary for contractors seeking to capitalize on the benefits of the system.

2.2 Current Industry Knowledge

The Last Planner® System reinforces the controls of a project by working throughout the project to see that prerequisites to activities are met so work processes can be conducted as scheduled. Howell and Ballard (2003) state that the LPS create and improve predictability of workflow on projects. These outcomes are the result of direct communication and planning ahead to identify work needed.

Measuring the completion of tasks is crucial to productivity and is conducted through the Percent Plan Complete (PPC) method instead of 'after-the-fact' variance detection traditional to the industry (Ballard, 2000). The PPC method compares the number of activities that a subcontractor completes to the number of activities that should have been completed, giving a percentage of planned tasks that were completed. Managing workflow as problems arise is in line with a pull system instead of the push system that is inherent in 'after-the-fact' variance detection.

In the push system of production, the needs of consumers are anticipated with the hopes of users demanding the goods once they reach the market. The goal of the LPS is to restructure workflow processes to a pull system instead of the traditional push system (Figure 1) inherent in schedules created with the Critical Path Method (Howell & Ballard, 2003). The pull system (Figure 2) of manufacturing denotes a system in which the consumer of a resource sets the production into motion through demand.

The pull system outlined in the LPS reorients the traditional push system to ask the last planners what work 'will' be done (hopefully) matching closely with what the construction drawings say 'should' be done within the constraints of what 'can' be done (Ballard, 2000).

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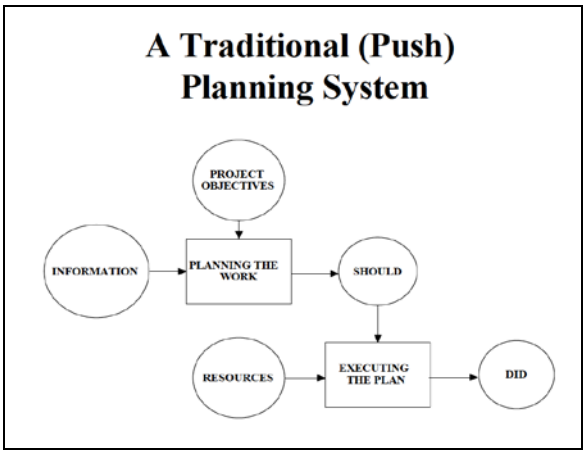

Figure 1: A traditional (Push) Planning System (Source: Ballard, 2000)

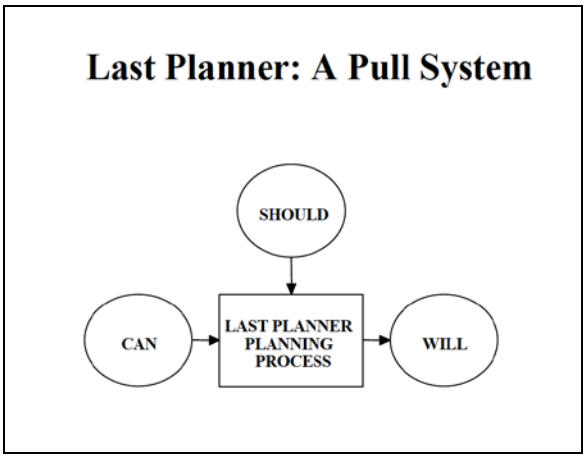

Figure 2: Last Planner®, A Pull System (Source: Ballard, 2000)

The adoption of the LPS has been slow in the last decade even though benefits of the system have been well documented. Many feel that the barriers come not from glitches in the framework but simply from failed management attempts to plan the implementation accordingly (Ballard, et. al, 2010). It is becoming more evident that successful implementation of the LPS framework comes not from the strict adherence to a practice or process, but rather from achieving buy-in from workers that understand the system.

Therefore, the current state of knowledge regarding the barriers and implementation of the Last Planner® System fall typically under the following areas:

1. Contractors seek to implement the LPS as a lean tool to increase project profitability through waste elimination and increased predictability of workflow processes.

2. Contractors commonly encounter barriers regarding the implementation and utilization of the LPS on projects, caused by a lack of understanding of the system.

3. Contractors currently lack established framework, backed by precedence, for the implementation and utilization of the LPS.

Understanding the current knowledge presented in literature allows for research to be conducted that will supplement current shortcomings. A need for understanding of the system and its drawbacks is clearly evident throughout the literature. Research that seeks to aid in the development and understanding of the system will be of great value to the construction industry moving forward.

2.3 Problems with Implementation

Based on the extensive review of literature from scholarly journals, technical articles, conference proceedings, and reports—barriers to the implementation and utilization of the Last Planner® System can be identified. The following issues are found to be prevalent throughout the literature:

Poor Planning*:* Many failures of LPS implementation can be tied directly to a failure to plan for its usage on the project. The core problem lies in the lack of implementation planning just like the poor planning on the projects that the LPS was created to help (Hamzeh & Bergstrom, 2010).

Lack of Leadership: Some failures of implementation resulted from a clear lack of leadership within the organization. In those failures there was a lack of commitment by upper management or top down mandates without active support (Ballard et. al., 2007). When no specific person is responsible for 'championing' the use of the system during implementation it is much more likely to fail.

Implementation Time Frame: Establishing usage of the LPS at phases throughout the project greatly hinders successful usage of the system. The LPS does have a learning curve that project team members must overcome. Implementing LPS at any time other than the beginning of a project greatly hinders successful utilization of the system (Hamzeh & Bergstrom, 2010).

Organizational Change: Commitment to a lean transformation is required for the successful implementation of the LPS. Fundamental change at the organizational level is very difficult to achieve in the short-term (Hamzeh & Bergstrom, 2010). Implementing the LPS is not simply applying a tool to a project—but changing the way the project team thinks, works, and executes tasks (Ballard, et. al, 2007).

Training: A lack of training and understanding of the system is seen as potentially the greatest barrier faced in LPS implementation. A lack of project team understanding is likely the root cause of other barriers such as the resistance to change that organizations face when implementing the LPS (Ballard, 2000).

These barriers are not meant to serve as an exhaustive list but instead denote barriers of failed implementations that organizations commonly encounter when utilizing the

system. Companies must make a concerted effort to be ahead of the curve on new technologies and training methods for implementing the system and make an organizational commitment to a lean transformation. When upfront planning and top-down commitment are made to the system through a lean transformation, these issues should not arise.

3 The Last Planner® System of Production Control

3.1 Overview

The Last Planner® System (LPS) is a fundamentally different method for controlling production workflow on construction projects. The system asks trade foremen, also known as "last planners", to plan work that can be made ready to perform efficiently, safely, and to a certain level of quality (Hamez, 2009). The LPS was first introduced in the United States by Greg Howell and Glenn Ballard in the early 1990s and has since been utilized on projects in the United Kingdom, Denmark, Finland, Indonesia, Australia, Venezuela, Brazil, Chile, Ecuador, and Peru (Ballard & Howell, 2003). The system is based on a new theoretical approach to scheduling that considers lean principles production flow. The system is of great benefit because of the following planning attributes: (1) planning in greater detail as work gets closer, (2) those performing the work are involved in planning, (3) identifying and removing work constraints increases reliability, (4) work is promised and execution is coordinated by trade partners and project team members, and (5) the continuous learning that results by finding root causes and taking preventative actions (Hamez, 2009). These attributes have contributed greatly to the popularity and adoption of this system around the globe.

In the LPS, production is thought of as flow, like a manufacturing assembly line, leading to an emphasis on reduction of uncertainty and on stemming the penalties of uncertainty (Koskenvesa & Koskela, 2005). Removing uncertainty means that workers will waste less time completing tasks that do not contribute value to the owner—while allowing contractors to better manage risk.

The success of the LPS has led many contractors to adopt the system in hopes of increasing profitability and decreasing waste. Proponents state the reason the system is successful is because it aims to ensure that all preconditions of a task exist when the task is scheduled to begin—allowing workers to complete assigned activities without disturbance (Koskenvesa & Koskela, 2005; Hamez, 2009) This goal is realized through the system's four major components that are aimed at better managing workflow: *Master Scheduling, Phase Scheduling, Look-ahead Planning, Weekly Work Planning, and in some instances daily plans.*

3.2 Lean Project Delivery System™

The Lean Project Delivery System™ (LPDS) is a project delivery method that incorporates lean principles into the various stages of a project. The LPS is an important subset of the LPDS and is critical to its effective deployment (Forbes & Ahmed, 2011). The LPDS is broken down into five phases that enhance the delivery of the entire project (Figure 3). Key to the phases is the concept of "built-in" efficiencies in a project (e.g. considering constructability issues during the design phase, etc.).

Undergirding these principles is the idea of work structuring and production control—culminating in continuous learning.

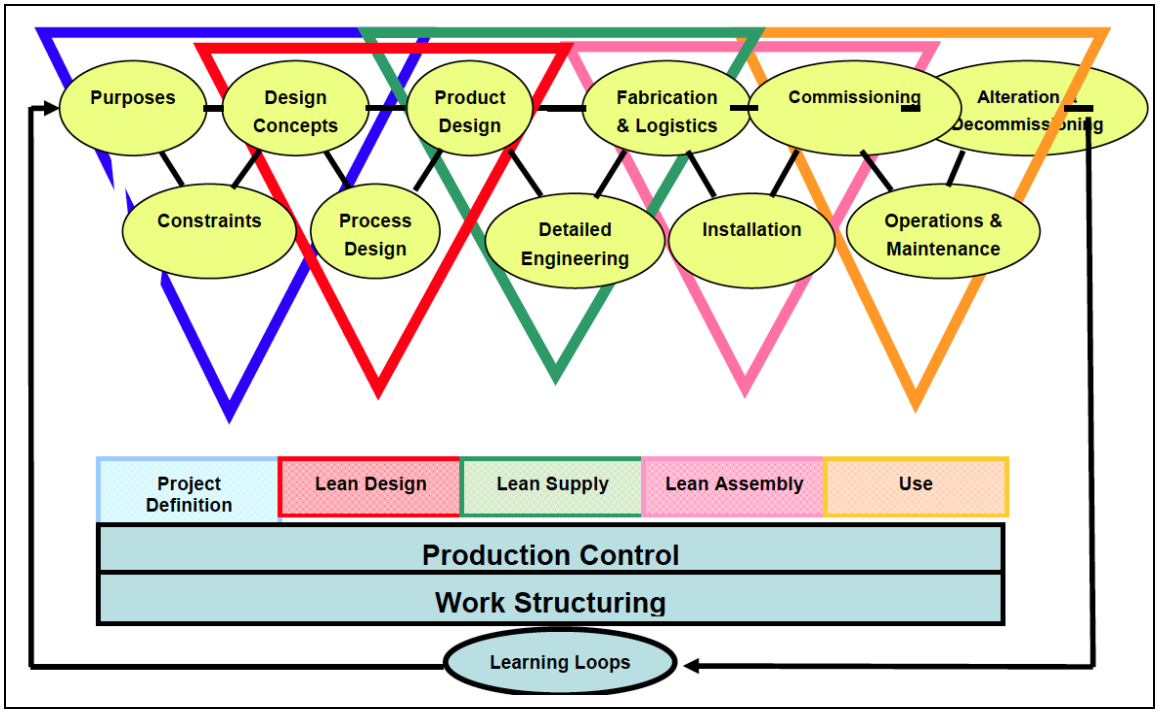

Fig. 3: Lean Project Delivery System™ (Source: Ballard, 2008)

Work structuring is a term developed by the Lean Construction Institute (LCI) to indicate process design (Ballard, 2008). The goal of structuring is to break work into defined production units that can be controlled—while simultaneously promoting flow. Dividing work into production units that can be controlled and monitored led Howell and Ballard to create the LPS.

According to Forbes and Ahmed, the LPDS improves project delivery by the following characteristics (Forbes & Ahmed, 2011):

1. Downstream stakeholders are involved in front-end planning and design through cross-functional teams.

2. Project control has the job of execution as opposed to reliance on after-the-fact variance detection.

3. Pull techniques are used to govern the flow of materials and information through networks of cooperating specialists.

4. Capacity and inventory buffers are used to absorb variability.

5. Feedback Loops are incorporated at every level, dedicated to rapid system adjustment (i.e., learning).

The LPS aides the LPDS in improving project predictability and is interwoven into the processes of the LPDS. The LPDS is Howell and Ballard's method for carrying out the ideas of lean construction; while LPS is a method for increasing predictability in the LPDS.

3.3 Components of the LPS

The LPS is comprised of four major components that address issues affecting the flow of production units throughout the duration of a construction project. The four tools, detailed below, include; *Master Scheduling, Phase Scheduling, Look-ahead Planning, and Weekly Work Planning*.

Master Schedule: The first step in front-end planning, translates owner's value proposition into a master schedule describing work to be carried out over the entire duration of the project (Hamez, 2009). It identifies major milestone dates and involves project-level activities mostly in relation to contract documents (Tommelein & Ballard, 1997).

Phase Schedule: Generates a detailed schedule covering all phases of the project and describes what tasks "Should" be done. It details a progressive detailing of the master schedule that is conducted by phase (Forbes & Ahmed, 2011).

Look-ahead Schedule: The first step in production planning uses screening and pulling to make tasks that "Should" be done into tasks that "Can" be done. Constraints are identified and responsibilities are assigned to members to remove them (Ballard & Howell, 1998).

Weekly Work Plan: Drives the production process, these could span a week but in some instances have moved to the daily operational level, called "daily huddles" (Hamez, 2009). The weekly work plan is also the level in which the percent plan complete (PPC) method is instituted—quantifying project success and profitability.

In the last planner process the master schedule is used to translate customer needs into value oriented milestones (Figure 4). *Phase scheduling* then utilizes "pull-planning" techniques to define activities and prerequisites for delivering those milestones. "Production planning starts with *look-ahead planning* which employs screening and pulling to make tasks ready for execution" (Forbes & Ahmed, 2011). These techniques ultimately culminate in producing a weekly plan to put work in place. The *Weekly Work Plan* drives the process from the backlog of "made-ready" tasks.

Finally, the LPDS system works best when all processes are developed in sync (i.e. schedules are compatible), involve project stakeholders, account for dynamic changes/updates, and utilize learning from planning failures for continuous improvement (Hamez, 2009). This understanding of a holistic delivery system—from conception through design and carrying into the construction process is what makes the LPDS a useful tool for lean construction.

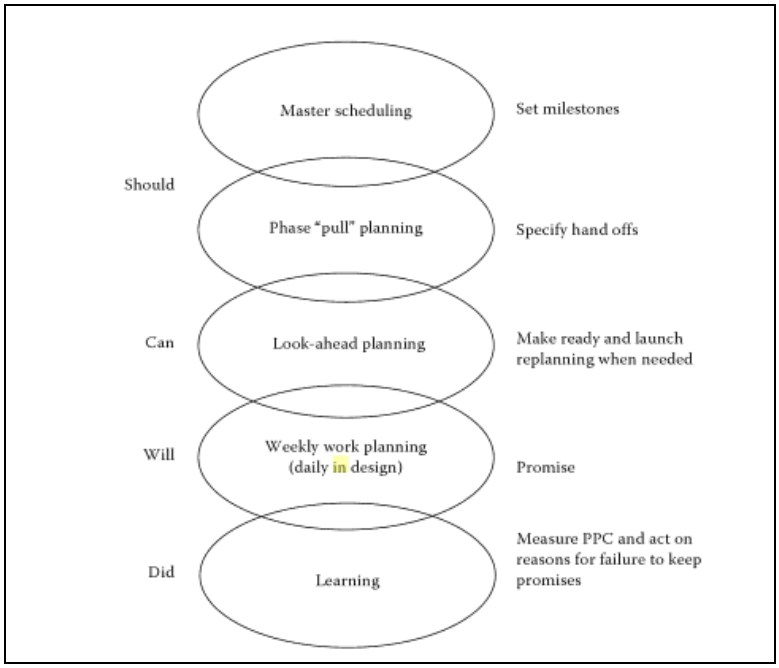

Figure 4: Interconnected Conversations (Source: Forbes & Ahmed, 2011)

4 Research Methodology

4.1 Overview

Essential to the design of the research method is the goal of obtaining data to support the aim of the research and help answer key questions raised in the initial stages of the study. In other words, the research design is an action plan for getting from 'here' to 'there', where 'here' is the initial set of questions to be answered, and 'there' is the answers to those key questions (Naoum, 2007). This action plan will culminate as a response to accomplish the goals set forth in the research objectives.

This research study is intended to provide contractors a reference for barriers that may be encountered during their attempts to implement the Last Planner® System on construction projects. The objectives of this study include:

- Providing practical solutions through applied research to the theoretical production management tools of the Last Planner® System.
- Understanding how contractor organizations implement and utilize the Last Planner® System of production control on construction projects.
- Identifying key barriers of the Last Planner® System on construction projects.
- Investigating possible solutions to barriers of implementing and utilizing the Last Planner® System of production control on construction projects.

Therefore, the research method chosen to gain those practical insights and data include the mixed methods research technique—in which both qualitative and quantitative

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methods were utilized. The survey instrument will also be described in detail, as it was the method for primary data collection.

4.2 Reasoning for Methodology

In reviewing the background literature of the Last Planner® System it became obvious that both quantitative and qualitative methods would be needed to conduct a thorough investigation of the research objectives. Quantitative measurements would be useful to digest the survey responses and provide hard data to the conclusions drawn from the survey. Similarly, qualitative research would allow respondents to answer questions regarding their own experiences with the LPS and provide useful insight to the research process.

This study sought to bridge the gap between the Last Planner® System's theoretical nature with a means to allow for discovery of practical applications through an enhanced framework for barrier identification. The research methodology framework is outlined in Figure 5.

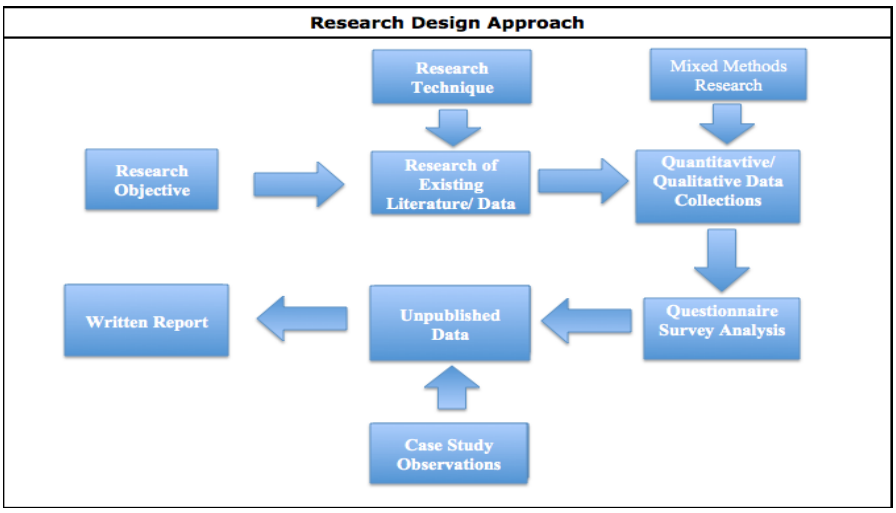

Figure 5: Research Methodology Framework

The purpose of the research methodology framework in (Figure 5) is to outline the crucial steps required in the process of this research study. Beginning with the research objective various steps are taken to formulate the written report that responds to the research objectives. Though many interpretations may be taken from the same data it is the researcher's responsibility to provide evidence for the assertions made within the report.

4.3 Primary and Secondary Data

There are two types of data used in the formulation of this report. First there is primary data described as, "data observed or collected directly from first-hand experience" (Naoum, 2007). Next there is secondary data, described as "published data and data collected in the past from other researchers" (Naoum, 2007). The secondary data in this report is the literature review that provided the existing knowledge of the subject. From this data the report gained a historical perspective on the topic of the LPS and the available knowledge of the system.

From the secondary data a survey questionnaire was formulated to gain first hand information of the LPS, which culminated in our primary data. These two data sources provide the necessary information needed to formulate responses to the research objectives.

An extensive literature search was needed in order to gain an understanding of the LPS and the existing knowledge of the system. From this research it was apparent that the system lacked a tangible framework for implementation. Many articles from the authors Glenn Ballard and Greg Howell of the *Lean Construction Institute* along with many others were consulted in the formulation of this report. Therefore, the barriers in the survey questionnaire stem from deficiencies and historical issues identified in those articles.

4.4 Survey Questionnaire

The method for collecting primary data in this research study was the survey questionnaire. This method of data collection aims to gather insight from industry participants' current in the means and methods of implementing and utilizing the LPS. From the respondents answers an analysis will be conducted to make inferences regarding the current use of the system and in what direction it may be heading.

The survey questionnaire allows for anonymous data collection of a certain population considered to be of adequate size. Questionnaires are composed of two types of questions: 'open' or restricted and 'closed' or unrestricted (Naoum, 2007). The survey used for this study consisted of both open and closed questions. The open questions allow survey respondents to input custom responses and the closed questions require respondents to select supplied answers. The closed question type allows for a better understanding of industry trends while the open questions allow for a broad understanding of a specific topic.

According to Naoum, there are three key issues imperative to the construction of the survey questionnaire: Question Design, Sampling Procedure and Data Collection (Naoum, 2007). For this survey the question design was developed from the key questions and research objectives mentioned earlier. The survey was sent to over 250 construction firms around the United States in order to gain a sufficient sample size.

5 Data Analysis and Evaluation

5.1 Overview

To analyze the results of the survey questionnaire it is important to evaluate the data as presented in order to reduce bias (Naoum, 2007). Limiting bias in results is difficult but necessary to ensure the validity of the study and potential findings. The results of the questionnaire survey used in this report are presented below with a clear description of what the data indicates. Extrapolating a more generalized significance regarding industry-wide trends should be done carefully as not to make inferences beyond the scope of realized data.

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5.2 Survey Results

5.2.1 GOAL I: Population Identifiers

Before evaluating the survey it is important to understand which companies responded to the questionnaire survey. To accomplish this goal the initial questions of the survey sought to identify key characteristics of those entities.

The characteristics identified below will seek to identify typical traits among contractor organizations implementing the LPS. Many of the contractors participating in this survey operate in multiple market segments—with a majority of participants focusing on the commercial and institutional markets (Figure 6).

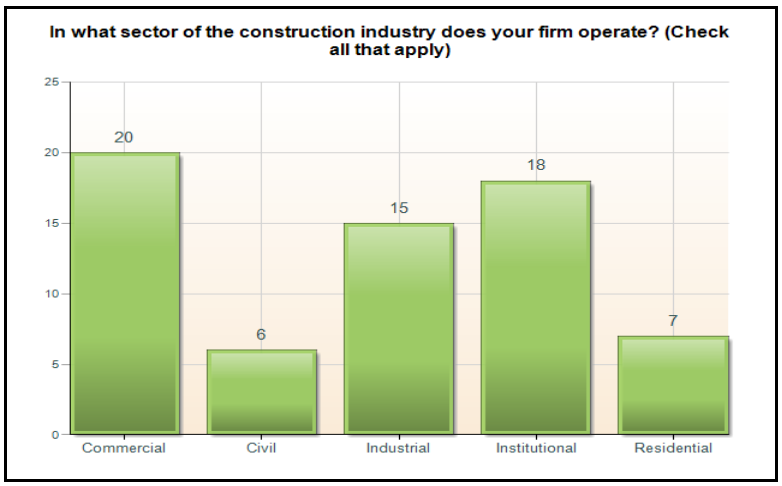

Figure 6: Contractor's Market Segments

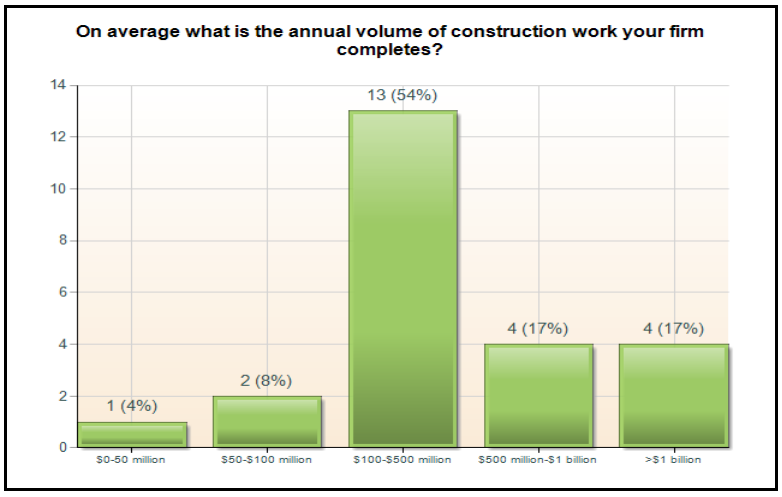

Figure 7: Contractor's Average Yearly Volume

Figure 7 depicts the contractor's typical contract volume completed within a year. The majority (54%) of respondents claim to complete on average between $100 - $500 million dollars worth of construction volume annually.

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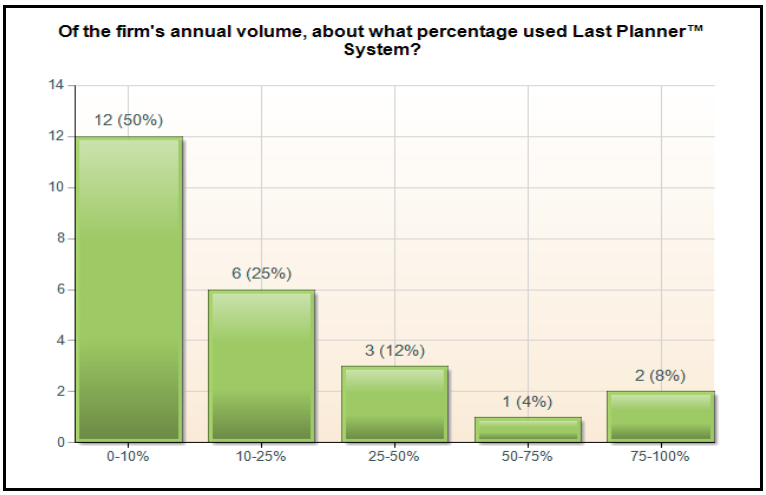

Figure 8: Yearly Volume Utilizing LPS

Figure 8 shows that most contractors surveyed only utilize the LPS for between 0 -10% of their construction volume. History shows that the construction industry is slow to adopt new practices without clear precedents for success and tangible implementation procedures (Graham & Reginato, 2011). The relatively small utilization of the LPS for projects could be linked to the learning curve associated with adopting and implementing the system.

In conclusion, industry participants utilizing the LPS seem to vary leading to the conclusion that firms across the spectrum are using the system to some extent. However, within that broad spectrum the survey data shows that firms in the commercial and institutional market segments are most heavily using the system. Further, firms with an annual volume between $100-500 million (54%) are mostly participating in LPS utilization. Those firms utilizing the LPS show reluctance for widespread adoption—with data showing that only (50%) of respondents utilizing the system on less than 10% of the firm's annual construction volume.

5.2.2 GOAL II: Projects Best-Suited for the Last Planner® System

The secondary focus of the survey was to identify a key type (if applicable) of project that is best suited for utilization of the LPS. In order to determine trends in project factors, respondents were asked to quantify variables related to project type and delivery method.

The goal for understanding what type of projects respondents typically utilize the LPS on is to gain a general understanding of the factors that influence a contractor's decision for choosing the system.

Figure 9 shows that (38%) of respondents identified *Integrated Project Delivery (IPD)* and another (38%) stating that *none are more important than the other* for the system's utilization. In IPD project teams are more reliant upon each other to successfully complete the requirements of the project, making the LPS attractive due to its collaborative workflow management. However, respondents do not identify one method over the other as superior for successful implementation.

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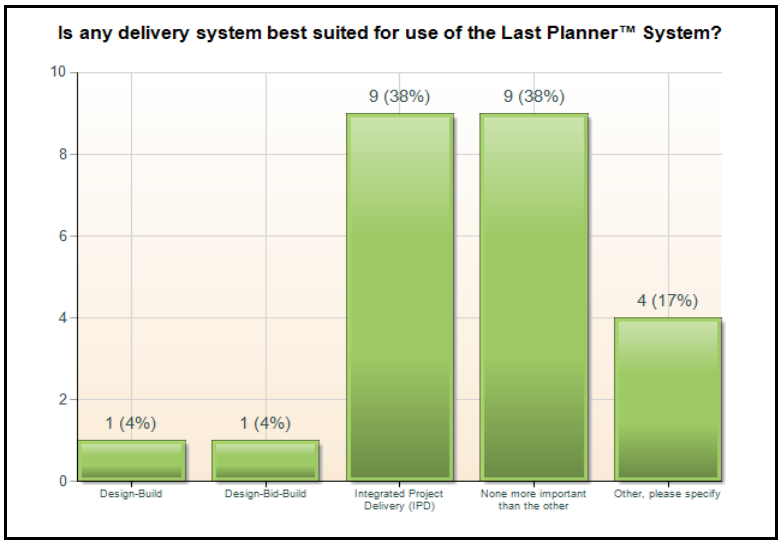

Figure 9: Key Delivery Methods for LPS

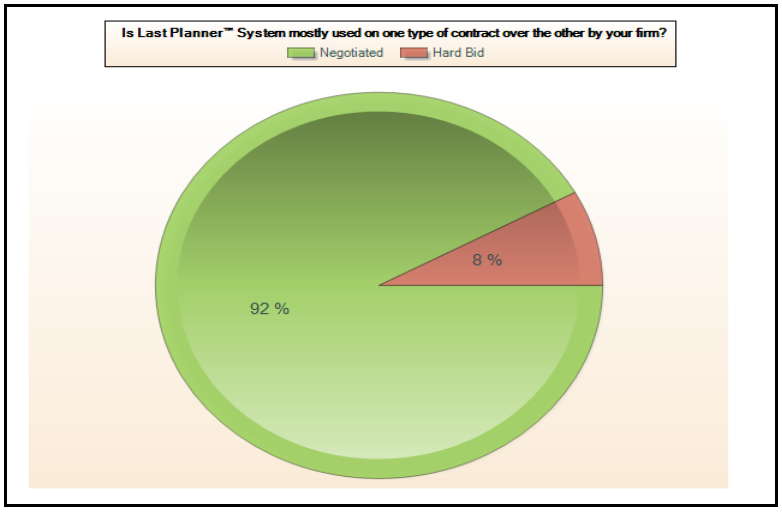

Figure 10: Negotiated v. Hard Bid

In determining an ideal contracting method for LPS utilization, Figure 10 shows that contractors, almost unanimously (92%), state that the system is most useful under situations in which the project has been negotiated. This again could be due to the learning curve associated with the system or the inherent adversarial nature of hard bid construction projects.

As demonstrated in Figure 11, contractors rank *healthcare* (42%) with *commercial* (38%) as the most susceptible project types for utilizing the LPS on projects. However, an even higher percentage of respondents rank *Other* (46%) as the best project type in which every respondent indicated that the project type was insignificant. This clearly demonstrates contractors' belief in the system as a workflow management tool—no matter the project market segment.

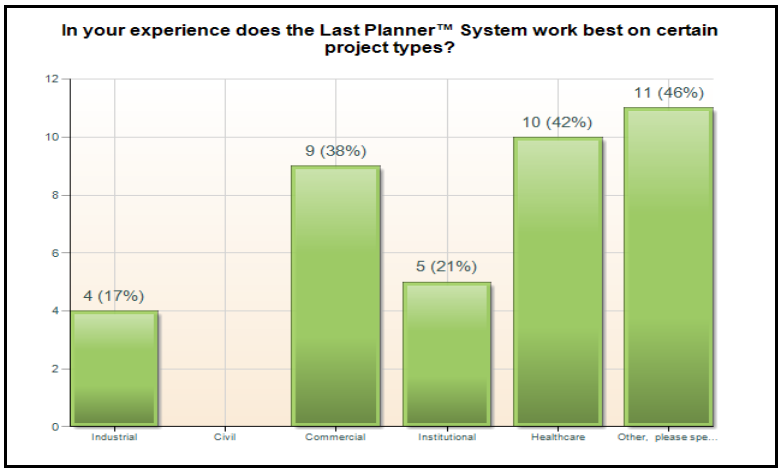

Figure 11: Business Segment of Project

Lastly, Figure 12 demonstrates the ideal contract amount that respondents believed the system was capable of successfully managing. The two main categories identified were the *$20-50 million* range (21%) and the *$50-100 million* range (17%). Both of these ranges were very low—with the major identifier (50%) being the *Other* category in which respondents again unanimously stated that the contract volume does not matter. This leads to the understanding that the system is not limited by the contract amount and can be used to successfully manage workflow of various project sizes.

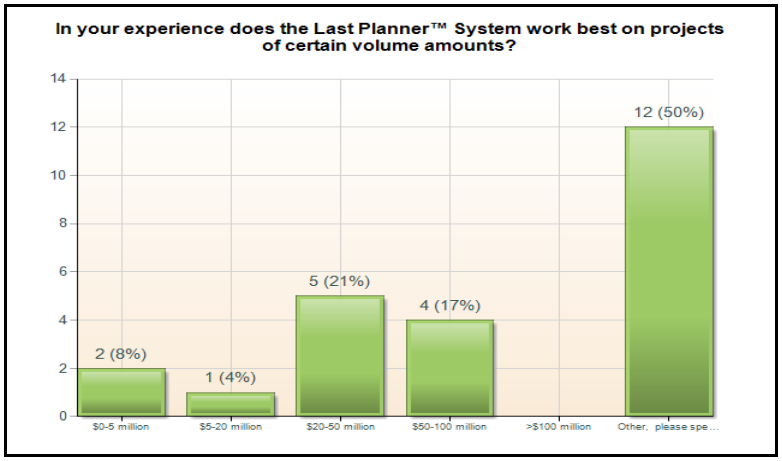

Figure 12: Contract Amount

In conclusion, survey respondents did not limit usage of the LPS to a best-suited project type. Instead a few key factors were heavily favored when implementing the system. Contractors favor the system's usage under a negotiated contract but did not limit LPS usage by market type, contract amount or delivery method leading to the conclusion that the system can be beneficial to contractors across the industry.

5.2.3 GOAL III: Key Factors Determining Utilization of the Last Planner® System

The third aim of the survey was to identify factors influencing the utilization of the Last Planner® System. In this phase of the survey respondents were asked to rank various

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factors such as; barriers at the project and corporate level, motivational factors for LPS usage and procedures to overcome the obstacles encountered.

Determining the key reasons contractors implement the LPS has been evident in the development and evolution of the system since its early formation (Howell & Ballard, 2003). To aid in this discovery, respondents were asked the context in which they implemented the system in order to gain a clear understanding of the setting in which barriers were encountered.

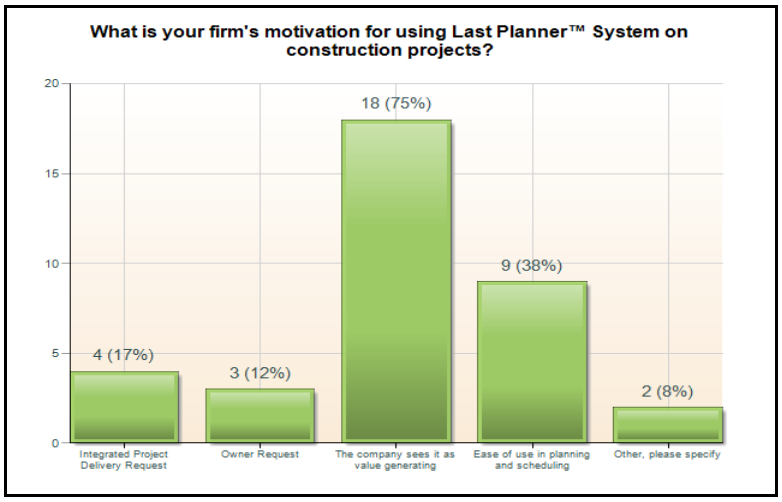

Figure 13: Motivation for Utilization

Figure 13 depicts the key factors that motivate contractors to implement the LPS. In order to gain a broad view of motivators there were five factors listed for respondent selection—with a majority (75%) of contractors identifying that the company believes the system is in line with the value-generating goal of lean construction. The next most respondents (38%) ranked *Ease of Use in Planning and Scheduling* as the reason they choose to implement the system.

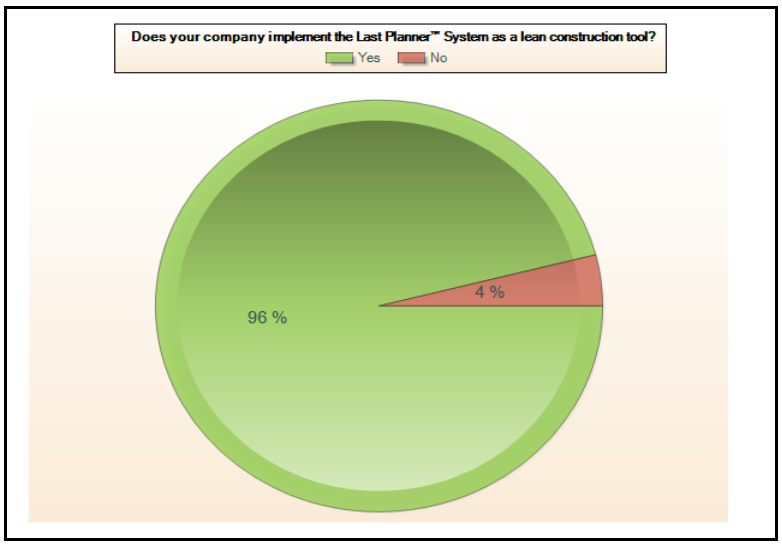

Figure 14: Lean Collaboration Tool

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Respondents also stated (96%) that the system should be implemented as a tool in collaboration with the firm's lean transformation initiative (Figure 14). This view is in line with Howell and Ballard, where the authors state that the system cannot expect to be successfully utilized in a firm that has not committed to the lean framework (Howell and Ballard, 2003).

5.2.4 Characteristics of Firm Utilization

In order to understand the importance firms place on the LPS, respondents were polled about the system in comparison to other methods of scheduling and planning workflow. (Figure 15) displays that a majority of respondents believe that a *Combination of Methods* (38%) should be used when managing projects. Another (25%) of respondents identified the LPS as vital to their scheduling and management needs. Similarly another (25%) said that they were unsure of the importance of different systems demonstrating a slow growing reliance on the system as a vital tool to manage workflow.

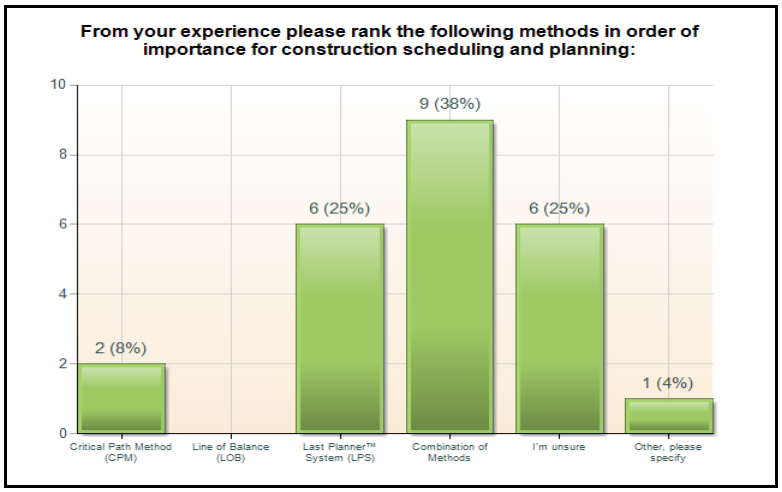

Figure 15: Importance of Systems

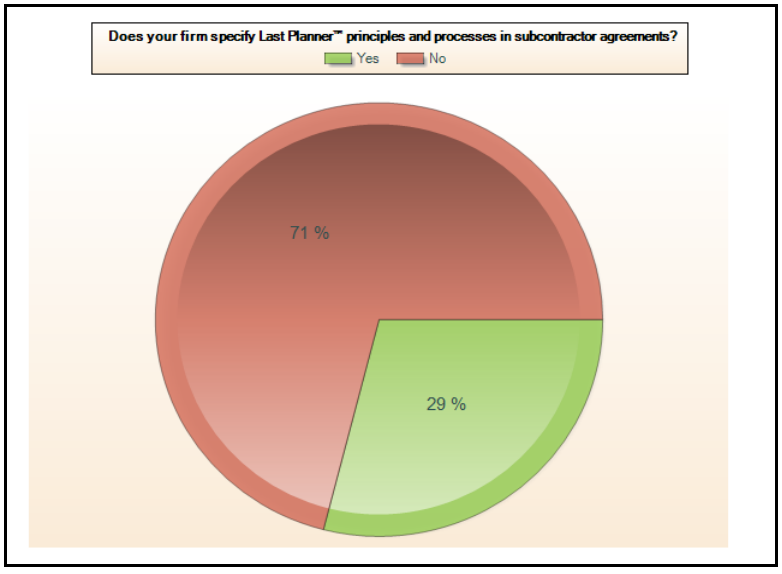

Figure 16: Subcontractor Agreements

When asked if respondents added contractual terms to subcontractor agreements requiring certain LPS principles to be observed, contractor's responded no (71%) of the time. However, (29%) of respondents did indicate that it was required demonstrating a possible growing trend of contractual integration of LPS principles in subcontractor agreements (Figure 16).

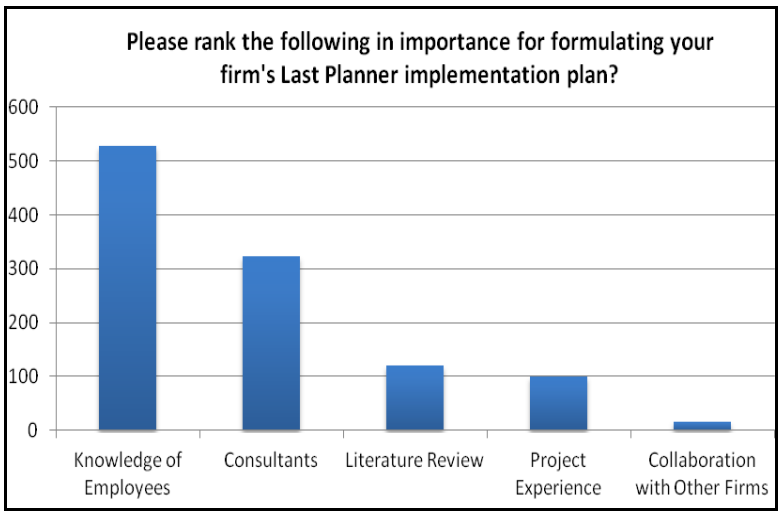

Figure 17: Implementation Plan Formulation

Lastly, respondents were asked about how they specifically implemented the LPS on a corporate basis for individual projects. To gain an understanding of how firms are preparing employees to utilize the system respondents were asked in Figure 5.12 to rank the methods they used to formulate implementation protocols. Data shows that respondents ranked the choices in order of importance as: *Knowledge of Employees, Project Experience, Collaboration with Other Firms, Literature Review and Consultants* (Figure 17). Surprisingly, contractors responded that only (50%) required project teams to attend training related to implementation.

5.2.5 Barriers to the System

In order to gain an understanding of the research aim of this study, respondents' were questioned about barriers they encountered when seeking to implement and utilize the LPS on construction projects. Barriers to be identified are located at the corporate level as well as the project level in which the system is actually utilized. The corporate level question seeks to display what barriers contractors believe to be a problematic when trying to achieve widespread usage.

In contrast, project level barriers seek to identify key issues faced when contractors implement the LPS on construction projects. Figure 18 shows that respondents ranked the corporate level barriers in order of importance as: *Resistance to Change, Lack of Buy-in From Top Management, Corporate Fragmentation, Technological Barriers, and Industry Climate.*

Ballard observed the implementation of LPS on various construction projects and documented similar barriers to implementation. Projects in the study experienced strong resistance to change on the part of project team members within the organization (Hamez & Bergstrom, 2010). In some cases, implementation challenges were the result

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of a lack of leadership during the process. In other cases, there was a lack of commitment by upper management or top down mandates (Hamez & Bergstrom, 2010). Contractors still struggle with the same issues observed by Ballard while studying the actual implementation of LPS on projects—further displaying a lack of advancement in implementation framework throughout the years.

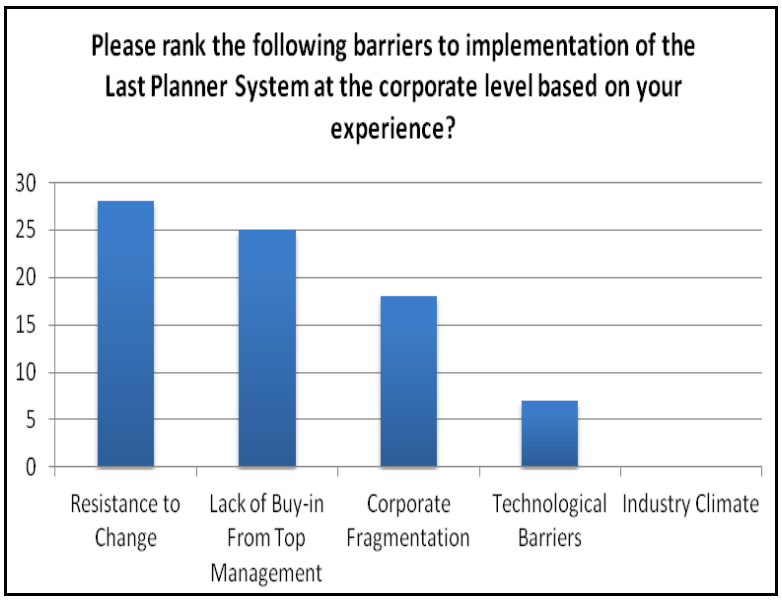

Figure 18: Corporate Level Barriers

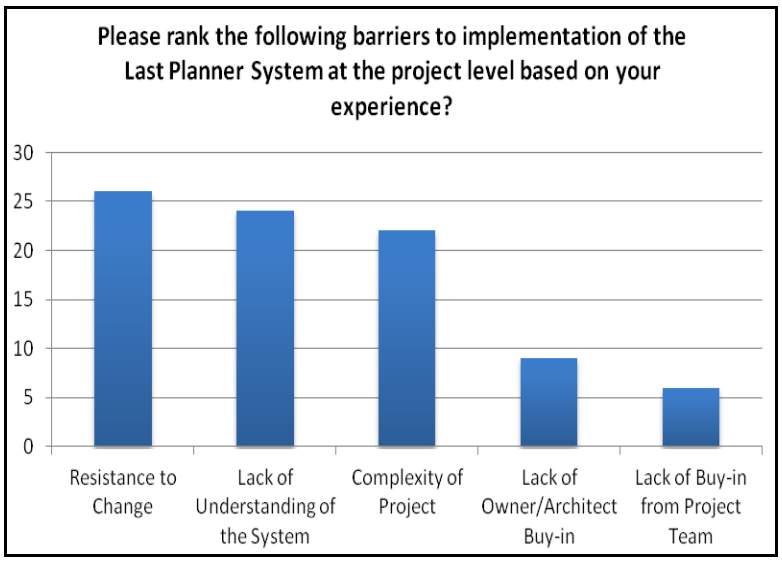

Figure 19: Project Level Barriers

Figure 19 ranks project level barriers in the following order of significance: Resistance to Change, Lack of Understanding of the LPS, Complexity of Project, Lack of Owner/Architect Buy-in and Lack of Buy-in From Project Team. This clearly relates to the corporate level barriers in that they are more tangible concerns that affect a working understanding of the system. If project team members do not understand the system or simply refuse to use it then the LPS is clearly unable to be of benefit to a project.

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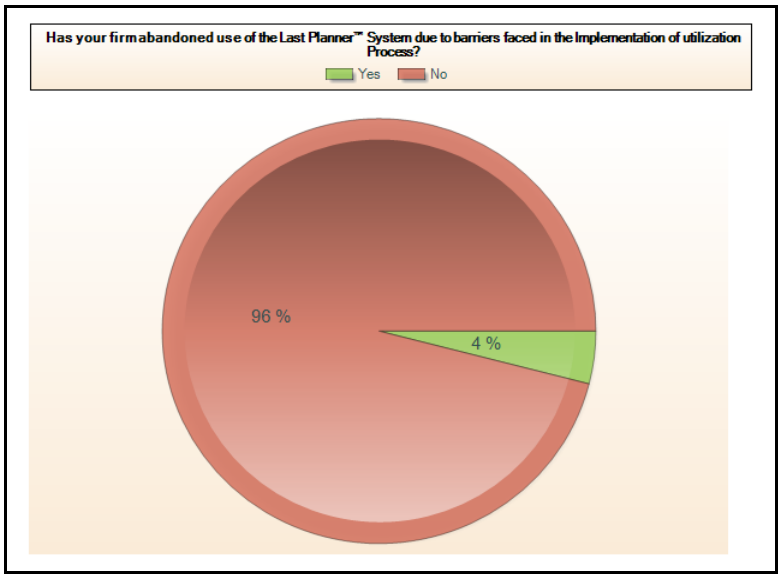

Figure 20: Abandonment of LPS

Finally, when contractors were questioned whether barriers resulted in the complete abandonment of the system only (4%) responded that they had indeed abandoned the system due to complications in the implementation process (Figure 20). This leads to the conclusion that the most significant barriers encountered in the implementation process are: *Resistance to Change, Lack of Buy-in From Top Management and Lack of Understanding.*

5.2.6 Overcoming Barriers to the Last Planner® System:

After obtaining a clear understanding of the obstacles faced by contractors it is important to understand the necessary steps contractors made to overcome those obstacles. Respondents listed LPS *Training* (*non-implementation based*) as the most important factor in overcoming barriers, followed by *Integrated Delivery with Knowledgeable Partners* as also being important (Figure 21).

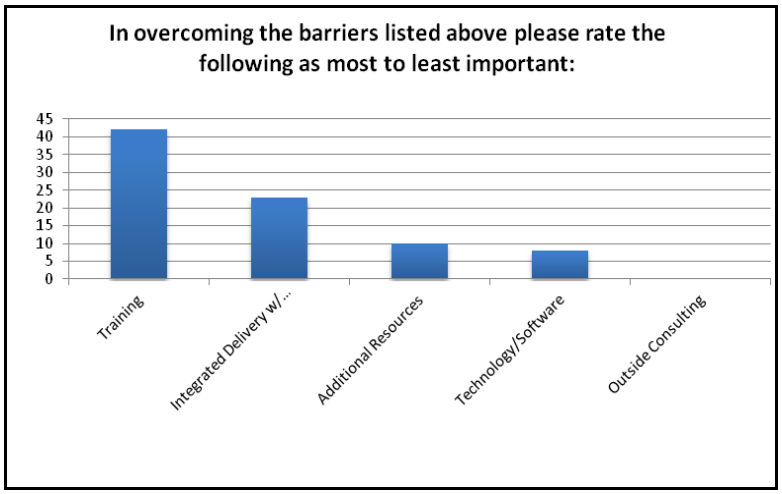

Figure 21: Mitigating Factors to Barriers

6 Conclusion and Recommendations

6.1 Conclusion of Results

This research study has observed barriers faced in the utilization and implementation of the Last Planner® System of the Lean Project Delivery System™. Respondents of the survey provided valuable insight to the issues contractors face when utilizing the LPS along with the methods used to overcome those barriers. With declining profitability and increasing competition the move towards lean construction practices will ultimately increase. Therefore, this research provides data to aid in the formulation of a necessary framework of the system.

The following factors were identified as key to the successful implementation of the system:

- Key Characteristics of Contractors Implementing the System
- Ideal Project Types for System Utilization
- Best Practices for Formulation of Implementation Plan for LPS
- Identified Corporate Level Barriers
- Identified Project Level Barriers
- Practices to Overcome Barriers

6.1.1 Scoring of Responses

Survey respondents were asked to rank factors pertaining to the LPS. The Likert Scale used was as follows and also had assigned intensity factors:

- Very Important (+2)
- Important (+1)
- Slightly Important/Neutral (0)
- No Effect (-1)
- Unimportant (-2)

To calculate the intensity of responses for each factor, the number of survey responses was multiplied by the assigned weight (e.g. 2, 1, 0, -1, -2) for that category.

Characteristics of those responding to this survey indicate that slightly over one-half of the respondents are contractors with an annual volume of $100 million to $500 million and are engaged in commercial, institutional and industrial construction. In addition half the respondents indicate that the LPS is used only rarely on their projects.

Also, about one-half of the respondents indicate that they are proponents of the LPS regardless of the type project or project size. However, the vast majority (92%) indicate that LPS utilization is best suited for negotiated contracts.

Tables 1, 2, 3 and 4 show the relative rankings that were observed through the course of this study.

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Table 1. Best Practices for Formulation of Implementation Plan for LPS

Rank		Score
1	Knowledge of Employees	23
2	Consultants	18
3	Literature Review	11
4	Project Experience	10
5	Collaboration with Other Firms	4

Table 2. Identified Corporate Level Barriers

Rank		Score
1	Resistance to Change	28
2	Lack of Buy-in From Top Management	25
3	Corporate Fragmentation	18
4	Technological Barriers	7
5	Industry Climate	0

Table 3. Identified Project Level Barriers

Rank		Score
1	Resistance to Change	26
2	Lack of Understanding of LPS	24
3	Complexity of Project	22
4	Lack of Owner/Architect Buy-in	9
5	Lack of Project Team Buy-in	6

Table 4. Practices to Overcome Barriers to LPS

Rank		Score
1	LPS Training (Non-Implementation based)	42
2	Integrated Delivery with Knowledgeable Partners	23
3	Additional Resources	10
4	Technology/Software	8
5	Outside Consulting	0

6.2 Recommendations

The data shows that widespread usage of this system is capable of producing favorable results. The LPS is a valuable tool to firms committed to lean principles. This system should not be used independently of a committed lean approach. Survey data shows that contractors implementing lean principles and the LPS commonly encounter resistance to change by firm's employees—greatly limiting the success of the system.

Respondents identified training as a very important aspect of the successful use of LPS. Removing the project team's fear of the risks associated with implementing a new system will come through educating the team of the potential barriers and benefits of the system. Respondents identified that an integrated form of delivery with knowledgeable partners is a very important part of overcoming the project team's resistance to change.

Therefore, in order to successfully implement the system: the human capital on construction projects must be incentivized to utilize the system, and be given proper resources and autonomy to successfully implement the system.

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Effectiveness of energy performance certification for the existing housing stock

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Abstract:
The energy saving potential of the housing stock is considered to be large. Also this is considered to be the sector where energy efficiency measures can be pursued in the most cost effective way. In Europe the Energy Performance of Buildings Directive is a driving force for member states to develop and strengthen energy performance regulations for new buildings and set up a system of energy certificates for the existing stock and develop improvement policies based on these regulation tools. The goals are to build net zero energy buildings in 2020 and to reach a neutral energy situation in the whole stock by 2050. By now in the Netherlands a large share of the housing stock is labelled (Energy Performance Certificate). This paper is based on a research in which the indicated energy use according to the issued labels are compared to the actual energy use in the dwellings. The results point out that the influence of occupants on the actual energy use are large and potential savings might be (far) less in practice: in low labeled dwellings the energy use is less than expected, in the high labeled dwellings the energy use is somewhat higher than expected. What is the impact of these findings for the improvement policies of governments and housing associations?

Keywords:
Energy performance certification, energy use, housing, policy, building control

1 Introduction

Buildings are responsible for approximately 40% of EU's energy consumption. In order to achieve a significant reduction in energy consumption of the residential and utility sector through informing renters and buyers of the energy consumption of their dwelling, the European Performance of Buildings Directive was issued in 2002, setting an EU framework for energy performance certification (EPBD 2002/91/EC). The general requirements of the 2002 EPBD regarding residential buildings were to develop a system of energy certification for new and existing buildings, regular inspections of heating and air-conditioning systems and setting of minimum energy performance standards for new buildings and extensively renovated existing buildings with a useful floor area over 1000m2. Mandatory energy certification , which is the focus of this paper, is set for all properties constructed, sold or rented out.

All member states have implemented the directive by the end of 2009, some more efficiently than others (Andaloro, 2010). The two major deficiencies of the directive as was concluded in the EU project IMPLEMENT, are the looseness of the regulations in the directive, which leave extensive room for interpretation and the fact that no sanctions are given in the cases where the rules of the EPDB are ignored (for example no energy certificate when selling a house). Furthermore, the European Project IDEAL-EPBD was specifically aimed at investigating why energy performance certificates seem hardly to motivate dwelling owners to take measures to improve the energy performance of their dwelling, proposing several policy improvements to improve the impact. However, all these projects are dealing with EPBD implementation strategically, overlooking the accuracy and outcomes of the calculation methods implemented. This undoubtedly varies throughout the EU, since the methodology of the energy performance certificates (EPC) has not been defined by the directive and is in hands of individual member states. They have developed very different approaches and methodologies. However, in 2004 the EC appointed the CEN (mandate M/343) to develop a series of standards. These include the following: EN 15217 (energy performance of buildings—ways of expressing energy performance of buildings and for energy certification); EN15603 (energy efficiency of buildings—overall energy use and definition of energy rating); EN ISO 13790 (energy performance of buildings - calculating energy used for heating and cooling). Still, the methodologies are not fully following the standards in all member states (Andaloro, 2010), including the Netherlands.

Despite having developed all the standards and despite the flood of information regarding the implementation of the directive itself, there are only a few studies examining the calculation method, and comparing the calculated energy consumption, which represents the basis for the label, with what the dwellings actually consume. It is clear that the theoretical values are merely an estimation of the actual consumption, since they are based on standard values and do not take occupant behaviour into account. However, the labels also provide homeowners/tenants with information on possible energy saving measures, and the pay back times of the measures are directly related to the theoretical consumption. Most energy reduction policies are based on the theoretical energy reduction potential. Consequently, future energy reduction targets are formulated. If the label is to become an efficient advocate for reducing household energy consumption in line with the set targets, the theoretical decrease in energy consumption when improving a dwelling's energy label should be close to the actual decrease of energy consumption. This paper aims to quantify, how the certification of buildings relates to actual energy consumption and how this fits the imposed targets for household energy consumption reduction, on the example of the Netherlands.

2 Existing studies on actual energy consumption

According to Perez (2008), the lack of a complete database of energy performance certificates on a national and EU level, hinders the evaluation of the energy saving policies. Poor availability and accessibility of energy label databases for researchers is probably the main reason for this topic to remain largely under researched. The limited available literature that relates the label of the dwellings to their actual performance are mostly based on small samples, with the intention of quantifying the impact of

occupancy as an explanation for differences. The following studies have been identified: Guerra Santin (2012) compared the actual and expected energy consumptions for 313 Dutch dwellings, built after 1996. The dwellings were categorised according to their EPC value (the Dutch energy performance coefficient for new buildings existed already prior to implementation of EPBD directive and has been periodically strengthened from 1996 on). The EPC (NEN 5128) calculation method is roughly similar to the energy index calculation method, which is nowadays used as the basis for the energy label. In energy inefficient buildings with a high EPC, actual heating energy consumption was almost twice lower than expected, whereas in buildings with a low EPC (energy efficient) both heating energy consumptions coincided much better. Due to the relatively small sample size the differences between the actual heating energy of buildings with different EPC values were insignificant, although the average consumption was consistently lower in buildings with lower EPC.

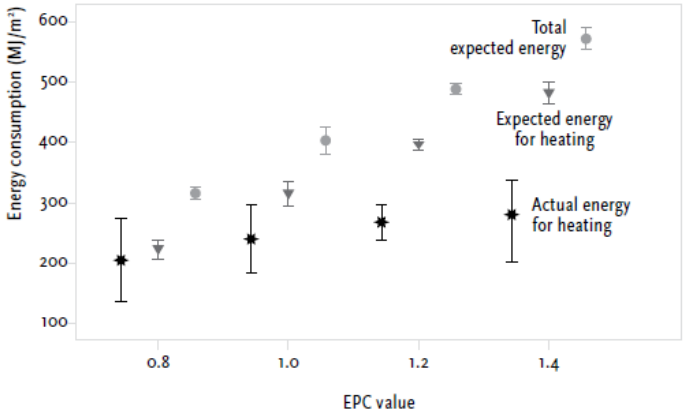

Figure 1: Mean and 95% confidence interval for the actual energy consumption (MJ/m2), total expected energy (MJ/m2) and expected energy for heating (MJ/m2) per EPC value (Source: Guerra Santin, 2012)

In another research conducted in The Netherlands by Tigchelaar (2011), a so-called heating factor was calculated (actual heat demand is divided by theoretical). The average heat factor in a sample of 4700 representative dwellings was found to be below one, meaning that the theoretical consumption is overestimated. Cayre et al. (2011) studied actual and theoretical energy consumption in 923 French dwellings and reached similar conclusions – the French EPC model overestimates the theoretical energy consumption in the sample, representative for the French dwelling stock. Similar was discovered by Hens (2010), observing actual consumption of two types of dwellings in Belgium (from 80s and 90s) – the consumption on average was only half of the calculated energy use. On the other hand, in 12 multi-family thermally retrofitted buildings in Austria, Haas (2000) has found evidence of actual energy consumption significantly exceeding the expected. Similar results were obtained by Branco (2004) in a multi-family complex in Switzerland and in a similar sample in France (Marchio, 1989). Based on these results, it seems that the theoretical energy consumption tends to be overestimated when looking at the average dwellings and less energy efficient dwellings and underestimated when observing new or retrofitted buildings. Usually this phenomenon can be partly explained by the so-called rebound effect (Berkhout, 2000). The idea is that more efficient technologies (such as a low energy dwelling) make

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energy services cheaper and thereby encourage to an increased consumption within the same service. A typical example of rebound effect was found to be the type of temperature control (Guerra Santin, 2010) - dwellings with thermostats actually turned out to consume more energy than dwellings without thermostat.

Sorrell (2009), provides an overview of methods for calculating rebound effect and a summary of available studies. He concludes accordingly, in OECD countries, that the mean value of the long-run direct rebound effect is likely to be less than 30%. This means that up to 30% of the efficiency gained through technical improvements of building and appliances are turned into increased consumption (higher comfort) following from direct change in user behaviour.

However, the size of the samples in these studies is relatively small, which sometimes leads to problems when assessing statistical significance of the results. Moreover, the representativeness of the sample is not addressed in the studies where the main goal is to investigate the sample and not the national dwelling stock. Therefore, even though there are some studies comparing the national theoretical energy consumption, which is the basis for energy label, it is very hard to predict what the energy label means globally within a member state. Even in countries where energy label databases do exist, there are only a few analyses of energy performance certificates available. The EPC in The Netherlands is based on the 'Decree on Energy Performance of Buildings' (BEG) and the 'Regulation on Energy Performance of Buildings' (REG) from December 2006. Despite the fact that the EPC fully came into force in 2008, however, the household energy data in The Netherlands does not show any relevant decrease in gas or consumption over the past 3 years (De Nederlandse Energiebranche, year) on a household level (taking temperature correction into account). The electricity and gas consumptions for the whole Dutch dwelling stock have also not decreased in the mentioned period (De Nederlandse Energiebranche, year).

3 Household energy efficiency and energy label in The Netherlands

3.1 The state of household energy efficiency in The Netherlands

The energy efficiency of the Dutch housing stock has improved by 28% (Odyssee ECN, 2009) in the period 1990 – 2008. The main reason for this significant improvement is believed to be the introduction of high efficiency condensing boilers. Moreover, the energy performance regulations for new dwellings have been strengthened, which has significantly increased the efficiency of newly constructed dwellings, resulting in halving their energy consumption in 2008 with respect to 1990. However, Guerra Santin (2010) argues that the trend of decreasing energy consumption in new dwellings has failed to continue after the year 1998, despite strengthening the EPC. Nevertheless, the improvements in energy efficiency can be noticed through the average household gas consumption in the same period (Odyssee ECN, 2009). Despite these promising achievement, the Dutch dwelling stock has grown steadily in the same period, approximately 1% each year. This two phenomena's together cause the total household gas consumption to stagnate rather than to decrease, despite the improved efficiency (Error! Reference source not found.). Even though the measures implemented in that period in the Netherlands place it in the lead of the European residential sectors (Odyssee ECN, 2009), there is no consistent evidence for reduction in gas consumption

(the consumption in 2008 was only 5% lower than in 1990) and moreover electricity and oil consumption have in the same period grown for 32 and 39% respectively, which means that the total energy consumed by household has also grown for 5%.

Yucel (2011) claims that new construction can only achieve a limited reduction of energy consumption within the sector, since it contributes about 1% annually with a small fraction of demolishment of about 0,2%. According to Yucel, the new construction causes a very marginal energy consumption reduction by 2020, assuming the expected periodic strengthening and demolition and new construction rates. Renovation of the existing stock together with increased turnover is seen as the solution in for significant reduction of energy consumption. The Energy label strives to promote renovation and the turnover of more efficient buildings. Regarding renovation of labelled dwellings, a research conducted in Denmark (Kjærbye, 2008) showed that there was no significant energy reduction within 4 years after owners purchased the house (and received the label), with the exception of label A in first two years after purchase. Unfortunately, no similar study was found for the Dutch case at the time of writing this paper. On the other hand, the increased turnover of more energy efficient buildings has been observed in the Netherlands by Kok and Brounen (2010). The data acquired in this study enables an insight into real potentials for future energy savings, which the energy label scheme can lead to and thereby assess whether it will help in achieving the set objectives or energy and CO2 reductions.

3.2 Method of calculating the Dutch energy label for dwellings

The first goal of labels is to provide occupants and home owners with information on the thermal quality of their dwellings. The Dutch energy label calculation is described in ISSO 82.3. To increase to practical significance of the label, the expected (theoretical) energy usage of the dwelling is also mentioned on the Dutch labels issued from January 2010, expressed in kWh electricity, m3 gas and/or GJ heat.

An energy label ranges from A++ to G (Table 1). The categories are determined based on the Energy Index, which is calculated on basis of total primary energy consumption demand (Q_{total}). Q_{total} sums up the primary energy consumed for heating, hot water, pumps/ventilators and lighting, subtracting for the energy gains from PV cells and/or cogeneration (Equation 1).

$$Q_{total} = Q_{space\,heating} + Q_{water\,heating} + Q_{aux.energy} + Q_{lighting} - Q_{pv} - Q_{cogeneration}$$

Equation 1: Calculation of total energy consumption (Q_{total})

The energy index directly correlates with total energy consumption, but is corrected for the floor area of the dwelling and the corresponding heat transmission areas (Equation 2) in order to not disadvantage larger dwellings and dwellings with a greater proportions of envelope adjoining the unheated spaces (different dwelling types) at constant insulation properties and efficiencies of the heating/ventilation/lighting system. A shape correction is applied also when considering infiltration losses within space heating demand – the air permeability coefficient depends on building shape factor. Such correction for compactness is common also in other European countries, although it has

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been previously argued that not correcting would better promote energy efficient architectural design (PREDAC WP4 report, 2003).

$$EI = \frac{Q_{total}}{155 \cdot A_{floor} + 106 \cdot A_{loss} + 9560}$$

Equation 2: Calculation of energy index (EI)

The total primary energy demand can also be expressed as described in equation 3. Since primary energy is an energy form found in nature, that has not been subjected to any conversion or transformation process, appropriate heating values need to be taken into account when calculating it. The assumed heating value for gas is 35,17MJ/m^3 and the energy content of 1kWh electricity is 3,6 MJ. The efficiency of the electricity network is considered to be 0,39.

$$Q_{total}[MJ] = Q_{gas}[m^3] \cdot 35,17 \left[\frac{MJ}{m^3}\right] + Q_{electricity}[kWh] \cdot 3,6 \left[\frac{MJ}{kWh}\right] : 0,39$$

Equation 3: Calculation of total primary energy

Carbon dioxide emissions depend on the fuel used. For 1MJ of energy coming from gas, 0,0506kg CO_2 is emitted into environment and for 1MJ of electricity, 0,0613kg CO_2 (this is taking into account the network efficiency).

ENERGY INDEX								
A++	**A+**	**A**	**B**	**C**	**D**	**E**	**F**	**G**
< 0,50	0,51- 0,70	0,71-1,05	1,06-1,30	1,31-1,60	1,61-2,00	2,01-2,40	2,41-2,90	> 2,9

Table 1: Dutch Energy labels and the corresponding energy index values

The Energy Index and consequently the energy label are based on average occupancy, average outdoor climate and does not depend on the variation in behaviour of the occupants. The energy index reflects the thermal quality of the building. The ventilation, internal heat production, energy use for lighting and heat losses during water circulation all depend directly on useful floor area, which are defined as areas that are a part of the heated zone, including the rarely heated areas such as halls, toilets, washing rooms and storages. The attic is also included if it is heated and the roof insulated. The cellar and garage or other big storage areas are not included, since they are normally outside of the thermal envelope. The ventilation is calculated using a ventilation coefficient, which depends on the ventilation type. The infiltration losses are relative to the type of dwelling, since for each type of dwelling, characteristic lengths of frames, joints etc. are assumed (ISSO 82.3). The efficiencies are set also for all kinds of heating and hot water installation systems. Heat gains from the sun are taken into account during the heating season at rate of 855MJ/m^2 on a south vertical surface, accounting for frames and dirt on the glass. Possible gains if energy through PV cells or micro co-generation plants are accounted for.

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4 Research methods and data

4.1 Energy label database

This research used all Dutch energy labels issued from beginning of January until December of 2010, counting over 340.000 cases with 43 variables (regarding building location and technical characteristics, properties of label itself etc.). This data set was provided by AgentschapNL – a public organisation appointed by the Dutch Ministry of the Interior and Kingdom Relations.

This data file was, on the basis of the address of the households, coupled to actual energy use data, which was provided by the CBS (Statistics Netherlands). CBS collets this data form the energy companies. The files of the two data sets were linked by the CBS to ensure anonymity. A clean-up of the combined data file (deletion of doubled addresses based on the label registration date, deletion of missing addresses based on missing value) was executed, leaving 247.174 cases. Because the CBS reported doubts about the quality of the data obtained for the actual energy of collective installations, it was decided to leave households with collective installation systems out of the analysis. Dwellings which have multiple installation systems were eliminated as well, since these are very specific cases. Cases where electricity consumption was 0 were removed as well, and missing values for gas consumption were defined. At this point, the gas values which were defined as missing were investigated. It turned out that most of them belong to dwellings with installations systems, which in fact do use gas. Such cases were deleted, and only the ones which use electricity as power source were kept in the database. The gas use was then redefined to 0 for these cases. Upon checking the theoretical energy use and areas of the house, outliers have been detected. The cases with the floor area of more than 1000m^2 and primary energy use of more than 500.000 MJ were discarded. Finally, the actual gas consumption values for 2009 were corrected towards the number of degree days used in the theoretical calculation. Ultimately, the sample contained 198.228 cases.

In this study, the variables energy index transformed into energy label, theoretical electricity consumption, theoretical gas consumption and actual electricity and gas consumption were used. Other variables, such as household floor area, dwelling type, construction and renovation year were examined to get an impression of the representativeness of the sample, but were not used in analysis.

4.2 Theoretical vs. actual energy consumption

The theoretical calculation method takes into account only energy for certain end uses and attempts not to take into account the end uses which are depend largely on occupant behaviour. On the other hand, as the name indicates, the actual gas and electricity consumption are derived from the dwellings energy bill and reflect the consumption for all possible purposes. An overview of differences can be seen in table 2. An important difference in electricity consumption are the household appliances which are not taken into account in theoretical calculation, but do appear on the electricity bill (and therefore in the database used). Appliances do constitute for 32,4% of household electricity consumption. The difference in gas consumption in gas used for cooking, which is only reflected in the actual value.

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	Theoretical	**Actual**	**% consumption of electricity/gas respectivelly**
Electricity	· Hot tap water	· Hot tap water&heating	14,7%
	· Heating/Cooling	· Heating/Cooling	17,6%
	· Auxiliary energy (pump/ electronics/ventilation in heating installation, ventilation system)	· Auxiliary energy (pump/ electronics/ventilation in heating installation, ventilation system)	unknown, very small
	· (Negative) PV/WKK production	· (Negative) PV/WKK production	unknown, very small
	· Lighting	· Lighting	14,7%
		· Household appliances	32,4%
Gas	· Heating	· Heating	72,7%
	· Hot tap water	· Hot tap water	23,3%
		· Cooking	3,9%

Table 2: Comparison of end uses of gas and electricity in actual and theoretical consumption together with their contribution within the Dutch dwelling stock (source milieucentraal.nl)

4.3 Representativeness of the sample

The total Dutch dwelling stock accounted for 7,104 million dwellings in 2009 (CBS Statline). The researched sample therefore represents slightly less than 0,3% of the total dwelling stock. Since there were only a few cases in categories A++ and A+ the A labels were all aggregated into one category. The distribution of labels was then more normal and the results statistically more significant. As one can observe from Figure 3, more than half of the dwellings in the energy label database belong to the categories C and D. As for the rest of the dwellings are concerned, only 1% belongs to either one of the three most efficient categories (A, A+ or A++) and around 4% to G, which is the label of the most energy intensive dwellings. In the total Dutch dwelling stock, there is a slightly lower percentage of dwellings labelled with B and C (Figure 3).

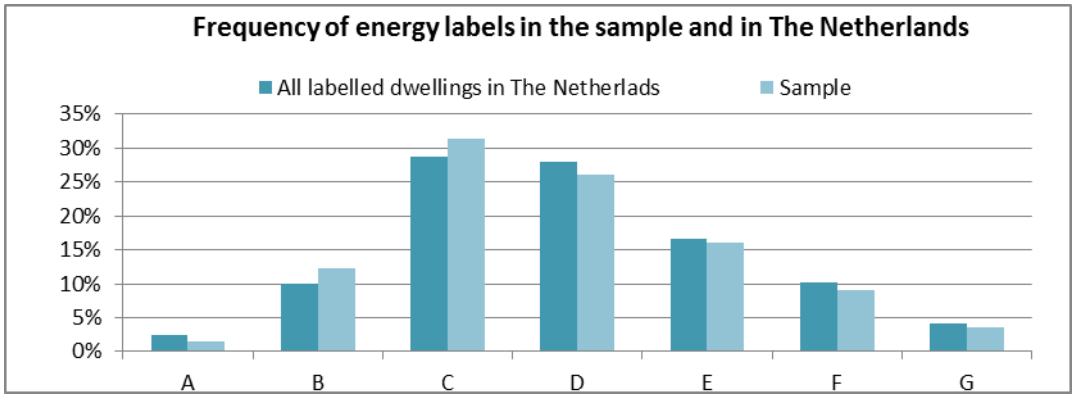

Figure 2: Shares of energy labels in the studied sample and in the Dutch dwelling stock (source Majcen and Itard, 2012)

Almost half of the dwellings were constructed in the 70s and 80s, until the year 1995. If this is compared to the whole Dutch dwelling stock, one can see that the distribution in the whole dwelling stock is slightly more even – more very new dwellings and more very old (Figure 3).

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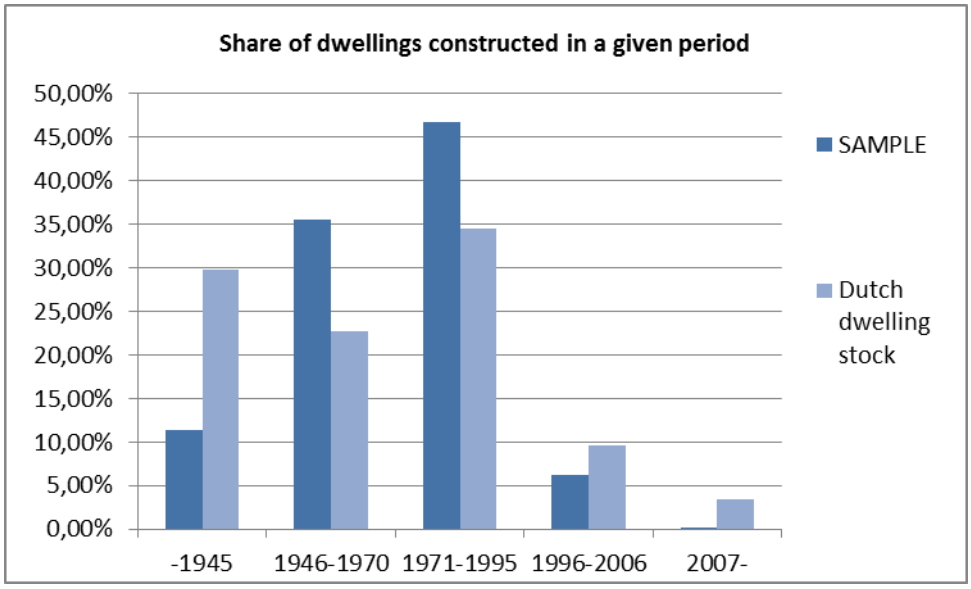

Figure 2: Number of dwellings per period of construction/renovation (source Majcen and Itard, 2012)

62% of Dutch dwellings are row houses. 11% of all dwellings are detached (single family) houses and the there is an equal share of apartments. This differs from the distribution in our sample of dwellings, which was aggregated to the same four categories in the Figure 5. The distribution of dwelling types according to the CBS in year 2009 is also plotted in Figure 5, and also differs slightly (the total stock is considered here to be 6,993 million dwellings). Discrepancy is the largest in the category of flats, which accounted for almost 36% of the sample, but represent only slightly more than 25% of the housing stock in 2008 according to the Energiecijfers database. There is less than average number of detached dwellings in the sample. On the other hand, there are more flats. This is also reflected in average size of a dwelling, which is more than 10m^2 smaller in the sample than is the Dutch average (Meijer & Itard, 2008).

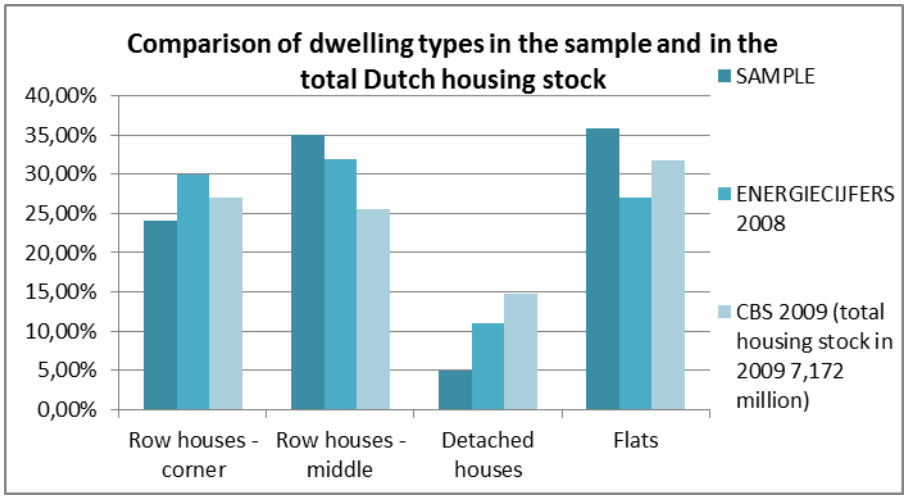

Figure 3: Representativeness of dwelling types in the sample and in the whole Dutch housing stock (source Majcen and Itard, 2012)

In terms of ownership structure, the sample differs significantly from the Dutch average (Energiecijfers database). Only slightly over 20% of the labelled dwellings are private owner occupant, while in the total dwelling stock the share is more than half (55%). Only 1% of dwellings in the sample is owner rental properties, whereas in the Netherlands, there are 12% of such dwellings. The third category is social housing, and is much better represented in the sample than in the total Dutch dwelling stock (79% vs. 33%), see Figure 6. This is caused for a large part by the lack of enforcement of this compulsory label for owner occupants.

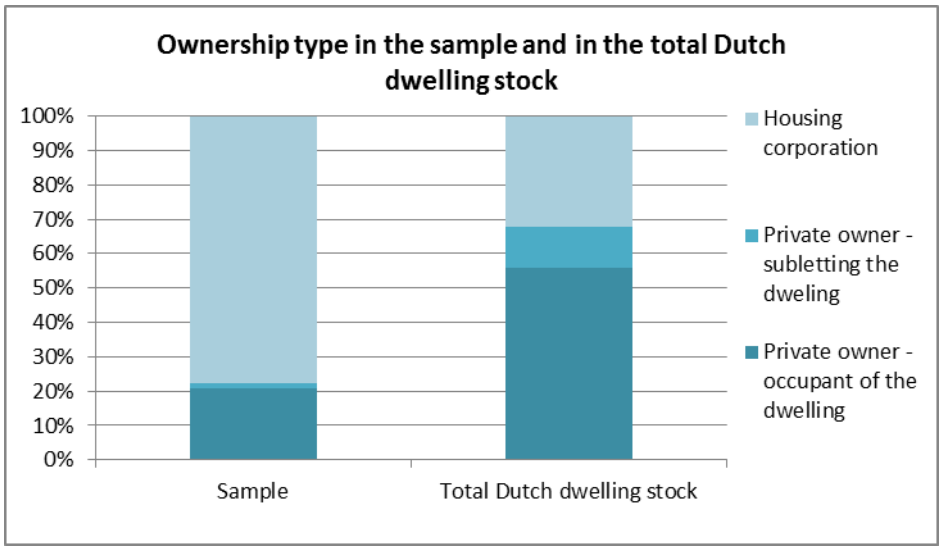

Figure 4: Ownership type distribution in the sample and in the total Dutch dwelling stock (source Majcen and Itard, 2012)

5 Results

5.1 Actual vs. theoretical energy consumption

First of all, a comparison was made between the actual and theoretical energy consumption per m^2 of dwelling in the abovementioned sample. The values appeared to be very well comparable, as can be seen from Figure 7. However, since it is known, that the theoretical consumption does not take into account end uses such as by household appliances (Table 2), which account for about 22% of total household energy consumption and gas for cooking, which contributes 1,3% it should intuitively be smaller. Because of gas and electricity as the two main energy sources in Dutch households are used for distinctive purposes, they are also examined separately in this study.

Within the analysed sample, the theoretical value for gas consumption is much higher than the actual, and the theoretical electricity consumption is significantly lower than the actual consumption of the same dwellings (Figure 7). In the case of electricity consumption, the fact that electricity from appliances is not taken into account, could to some extent cause the large underestimation of theoretical value, but judging from the values in Table 2 (appliances' contribution to electricity consumption is on average 32,4%, if the overestimation in our sample is due to appliances, they would contribute

64%) this is not the only cause. This might indicate that either the estimation for electricity consumption of household appliances is inaccurate, or the electricity consumption for hot tap water and heating are higher than predicted. As opposed to electricity, gas consumption is over predicted. Since the end uses of gas are the same with the exception of cooking, the differences in consumptions reflect either a deviation from assumed user behaviour or divergence from assumptions used to estimate space heating demand (air infiltration, U-values, floor area, transmission areas etc.) different than assumed in the theoretical calculation. This study does not aim to quantify where the discrepancies come from, but rather, the consequences of the inconsistencies for future household energy consumption.

In the total Dutch housing stock (Figure 7), 3480 kWh (32123 MJ) of electricity was consumed in a dwelling on average, according to Energie Nederland 2010. This is around 700 kWh (6224 MJ) more than the average in the studied sample. Similar goes for gas, around 1617 m^3 (56870 MJ) was the average consumption in 2010 according to Energie Nederland, whereas the consumption in our sample was app 1500 m^3 (52264 MJ). This discrepancy is likely to be caused by the larger average size of the dwellings in the whole Dutch dwelling stock.

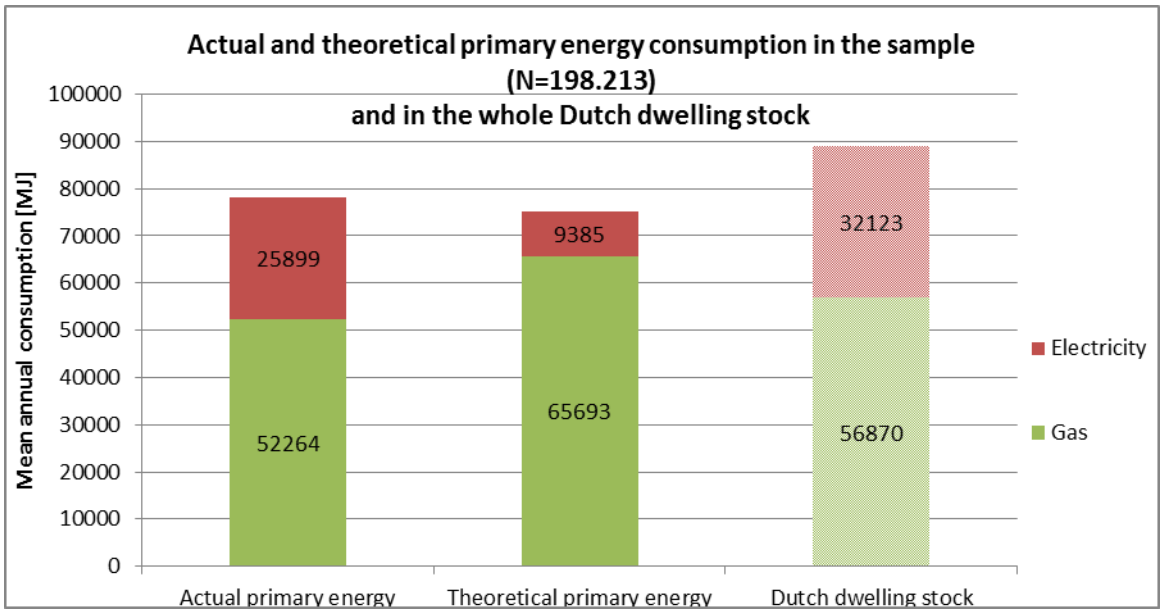

Figure 5: Actual and theoretical primary energy consumption in the sample and in the Dutch dwelling stock (source Majcen and Itard, 2012)

5.2 Energy consumption vs. energy label

5.2.1 Gas

To get an insight in how the energy label relates to the discrepancies described in the previous section, we examined gas and electricity consumption in the various label categories. The plots in this paper are presented with +/- 1 standard deviation. Because of the extremely large size of the sample it is not relevant to plot the 95% confidence

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interval, which is always very small, meaning that the location of the mean value is known almost without any uncertainty and all the differences were statistically significant on a 95% interval.

Figure 8 represents the actual and theoretical gas use per dwelling and Figure 9 the consumption per square meter of floor area of dwelling. What changes in the latter is the consumption of dwellings with label A, since those were found to be considerably larger than all other dwellings (Figure 10). From these figures it is clear that, although the increase of actual gas consumption corresponds to the increase in label, there is a clear difference between the mean theoretical and mean actual gas consumption of each label. For the most energy efficient categories: A, A+ and A++ as well as for category B Figure 8 and Figure 9 show underestimated theoretical gas consumption as opposed to the rest of the categories where the theoretical gas consumption is largely overestimated. The theoretical and actual values are only for label C quit similar. It is worth noting that in label category G, the actual gas consumption is only half of the theoretical consumption. The theoretical gas use predicts a much higher span between an energy efficient dwelling (A) and an energy intensive dwelling (G) than we observe in the actual gas use. If the two consumptions are thought of as a linear function, they greatly differ in their slope.

When standardizing the consumption per dwelling to the consumption per m^2 of dwelling, a better match between actual and theoretical gas consumption was expected since the dwellings could have different mean sizes in different categories. However, Figure 9 shows that this is not the case. The difference therefore does not arise because of different sizes of dwellings. It is noticeable that the standard deviation of theoretical consumption decreases in the Figure 9, meaning that the spreading in square meters floor area is responsible for a large part of the spreading in theoretical gas consumption at dwelling level.

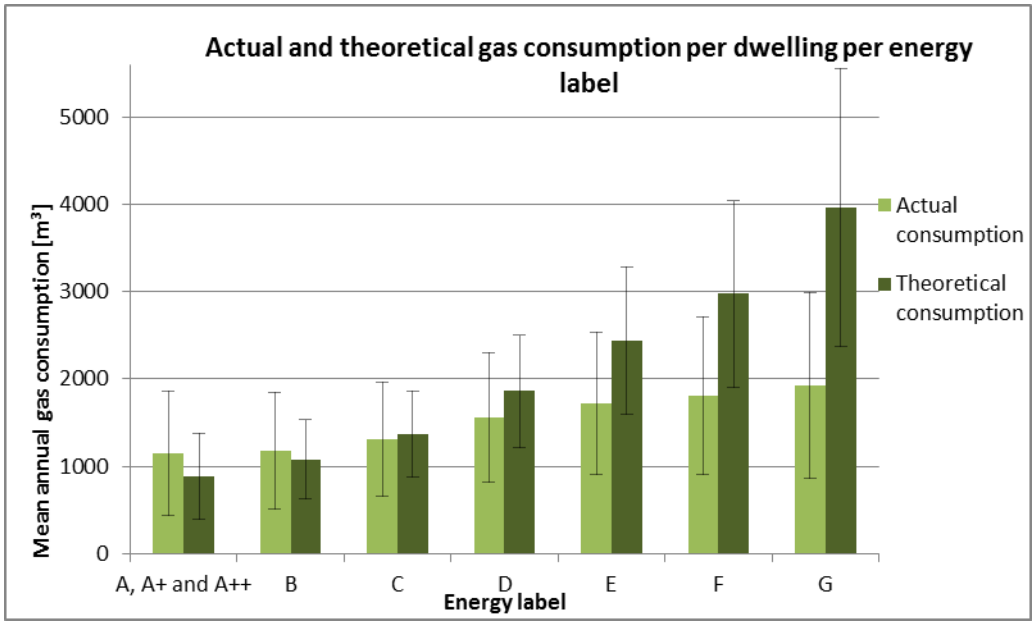

Figure 6: Actual and theoretical gas consumption per dwelling per label
(source Majcen and Itard, 2012)

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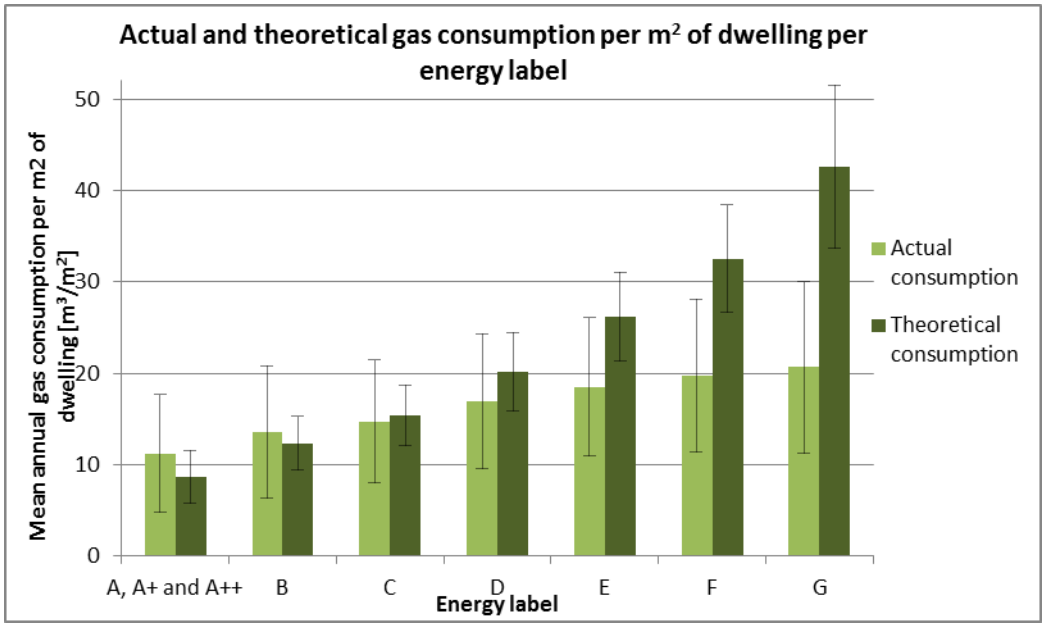

Figure 7: Actual and theoretical gas consumption per m2 of floor area per label (source Majcen and Itard, 2012)

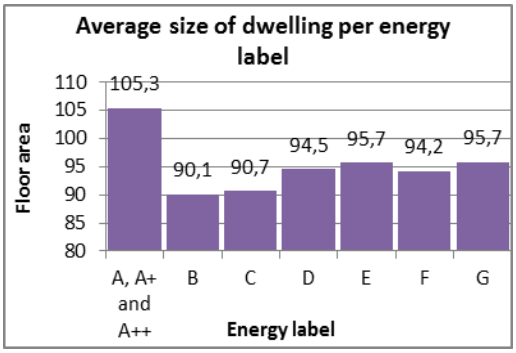

Figure 8: Average dwelling size (m2 floor area) in different label categories (source Majcen and Itard, 2012)

5.2.2 Electricity

As opposed to what we observed in the previous chapter on gas consumption, the theoretical electricity consumption is underestimated (Figure 7). In Figure 11 we can observe that both the actual and the theoretical electricity consumption does not depend much on the label. There is a very slight trend towards higher consumption in labels A, D and E which might be attributable to the electricity that is used for space and water heating in certain households or/and the larger floor areas.

Figure 12, where the electricity consumption is given per m^2 floor area, shows that the higher consumption in label A relates to larger floor areas, which seems not to be the case in labels D en E. The curve shows a slightly convex shape for the actual electricity consumption and a concave shape for the theoretical one, but finally the label will not appear to be very significant for the difference in electricity consumption. However, the

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differences between labels are very small compared to what was observed in gas consumption.

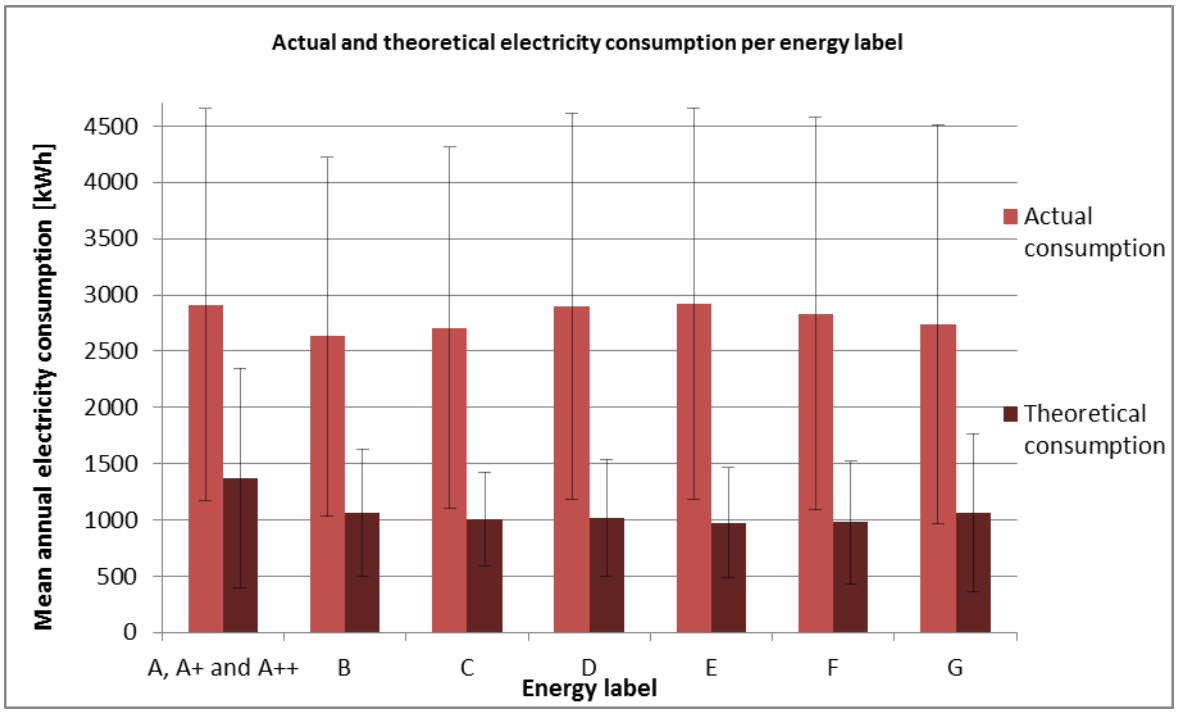

Figure 9: Electricity consumption in different label categories
(source Majcen and Itard, 2012)

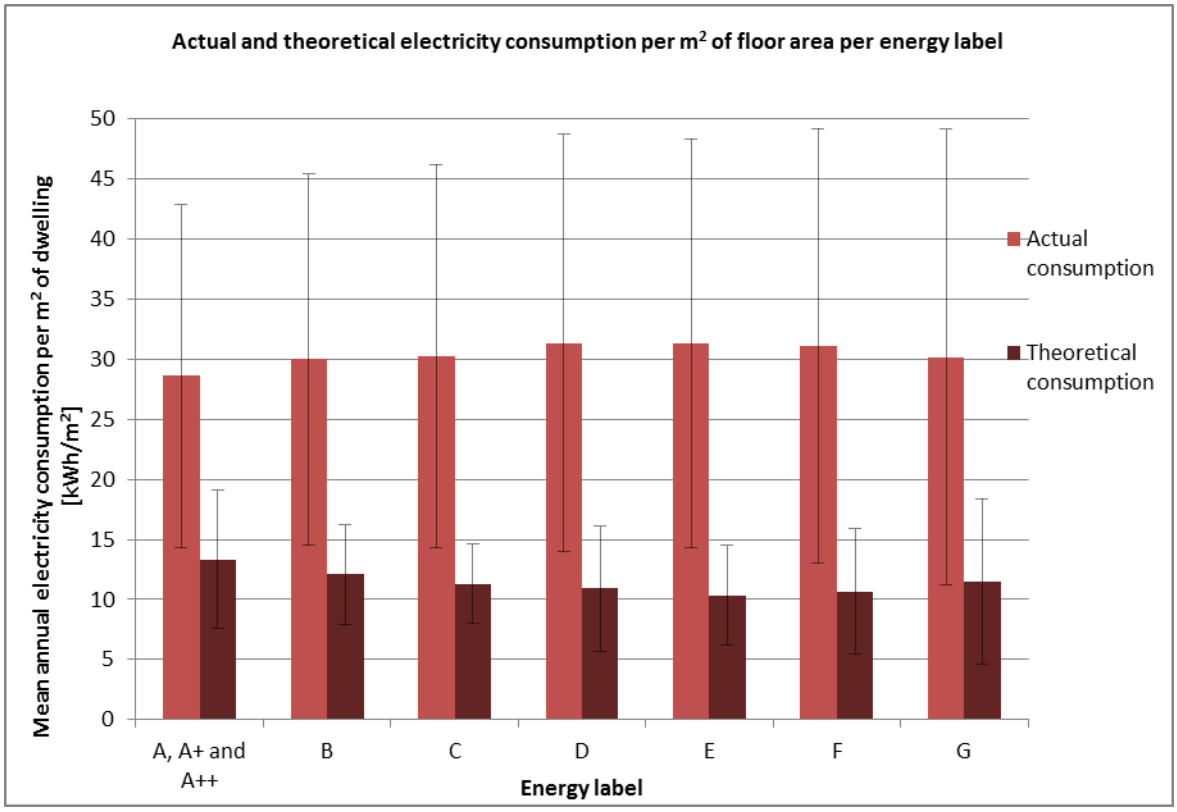

Figure 10: Electricity consumption per m2 dwelling in different label categories

(source Majcen and Itard, 2012)

5.3 Total primary energy and CO_2 emissions per label category

An interesting insight into the total primary energy consumption (Figure 13), can be gained if summing up the gas and electricity consumption according to equation 3. From this figure, the occupants in dwellings labelled with A – D label can expect to consume more than it is pointed out in the label. This will be partly a consequence of higher gas consumption and party due to the fact that the household appliances are not a part of the label.

However, what is worrying here is the fact that the span of theoretical consumption is much higher between label A and G than it is the case in reality (looking at actual values). This might have a very strong influence on the pay back times and on the achievable savings. The labels E to G seem to be consuming a very similar amount of actual primary energy, even though the technical characteristics are much better in E than in G. The label thus might reflect the technical characteristics of a dwelling, but if the actual primary energy consumption seems to be almost identical in each of the three categories, it might not be worth it to improve the technical specifications of houses labelled with G. From this figure it is clear that the savings which are expected to arise when improving the technical characteristics of a house, do not occur in practice. The theoretical primary energy consumption of label A is 70,2% lower than the consumption of label G, but the actual primary energy consumption of label A is only 27,8% lower than label G.

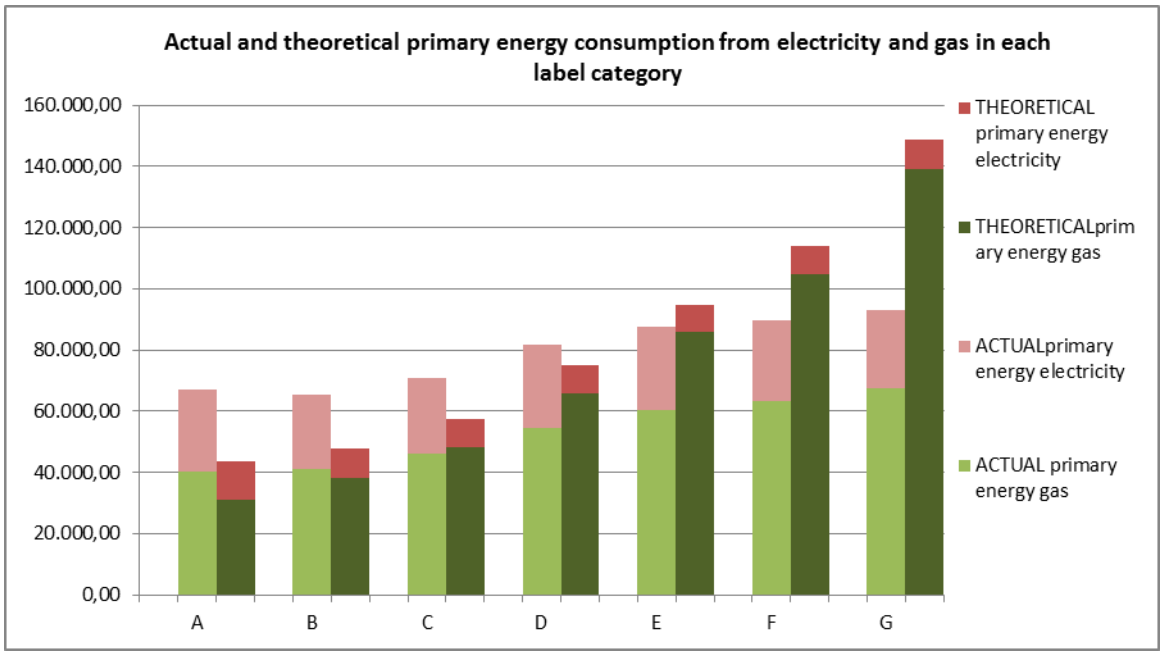

Figure 11: Primary energy consumption in different label categories

(source Majcen and Itard, 2012)

Moreover, since European targets are not solely aiming on reducing the energy consumption but also on reducing the CO_2 emissions, therefore it is illustrative to see what the energy label means in relation to CO_2 emissions. Since one megajoule of

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electricity produced in The Netherlands causes a larger CO_2 emission than a megajoule of gas (0,613kg vs. 0,508kg of CO_2 per MJ energy at household), a chart was produced, examining the emissions related to each label category. Electricity is responsible for more CO2 emissions per unit energy than gas, therefore it plays a stronger role in this chart. Theoretical CO_2 emissions are lower than actual in all labels except label G, because the household appliances are not taken into account in theoretical emissions. Interestingly, there is no significant decrease in CO_2 emissions among labels G, F and E and the label A is responsible for more CO_2 than the label B. The CO_2 emissions when improving a label from G to A, decrease for 55,4%, whereas in reality, looking at actual consumption, this decrease is only 13,1%.

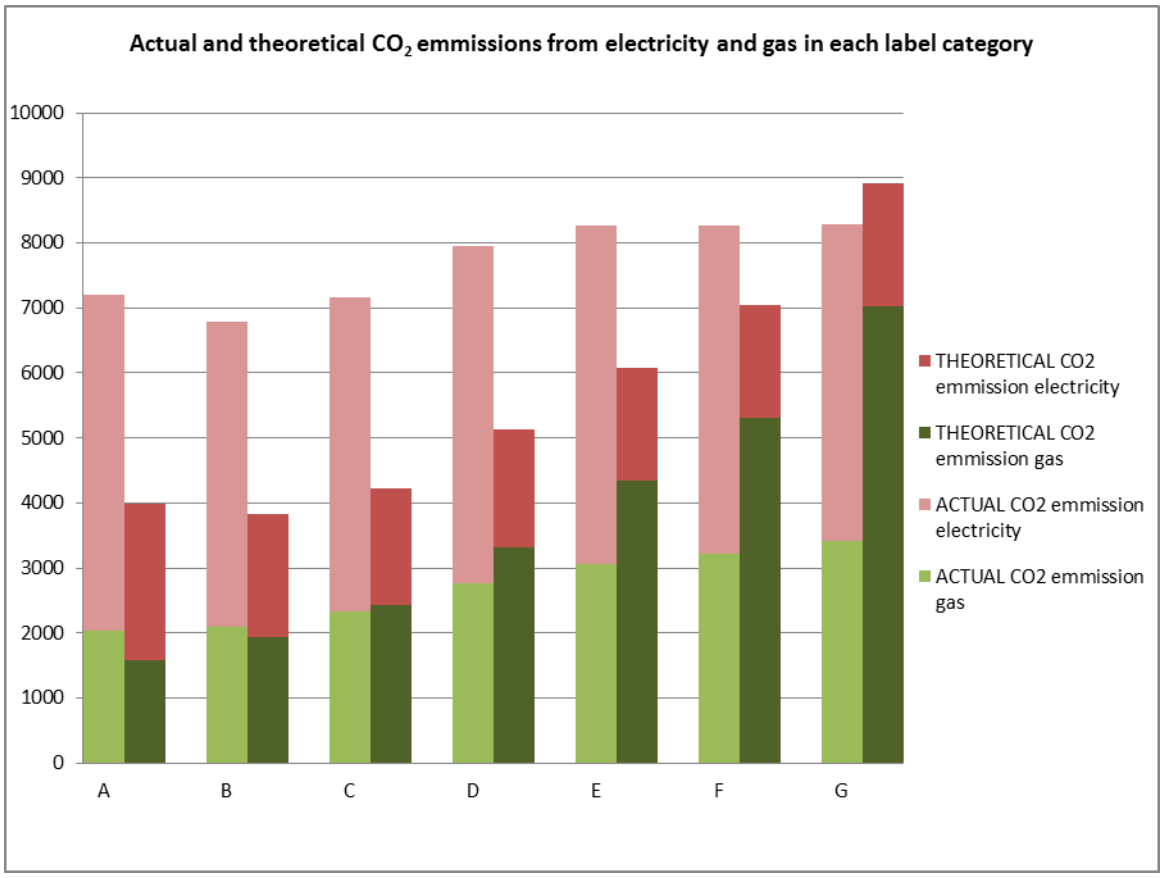

Figure 12: CO2 emmissions in different label categories (source Majcen and Itard, 2012)

6 Conclusion

This study was based on a large sample of households. Figure 3 showed the representativeness of the sample regarding the frequency of label categories, which was an important finding, since this study aimed to compare actual and theoretical energy consumption within a label and extrapolate the predictions which are made within the energy label calculation to the whole Dutch dwelling stock (section 4.4). Other aspects of the sample, such as type of dwellings or ownership type showed poorer representativeness, but this does not influence the results of this study, it might

however, be useful information for further research and helpful to explain why there is a large discrepancy between actual and theoretical energy consumption.

Considering the fact that most of the gas consumption in The Netherlands is used for space and water heating, it can be concluded also from this study that the actual heating energy consumption is on average lower than the theoretical for most dwellings (in our study for dwelling with labels C to G) as was observed previously by Guerra Santin (2012), Tigschelaar (2011), Cayre (2011) and Hens (2010). Guerra Santin already pointed out that at a lower EPC value (for new dwellings), the difference between expected and actual will be smaller. Our study has proved this, and showed that in very energy efficient dwellings actual gas consumption can even exceed the theoretical use (Figure 8). On the other hand, low efficient dwellings are characterised by over prediction of gas consumption, the theoretical gas consumption seems to be around twice the actual. On the contrary to gas consumption, the discrepancies between theoretical and actual in electricity consumptions in different label categories are relatively constant (Figure 11) and most of the difference is likely to arise from consumption of household appliances. The fact that labelled dwellings differ in gas consumption, but not much when it comes to electricity consumption proves, that the energy label can (on a large scale) only be efficient in reducing gas consumption, at least as long as this is the main source of heating energy. However, in in Figure 14 one can see the importance of electricity in the carbon footprint of households – it is responsible for approximately 2/3 of all CO_2 emissions, which is why efforts should be made in the future for reducing not just the household heating demand, but also the electricity demand.

An important finding of this study is, that the primary energy consumption reduction, which is assumed to happen when improving a building from label G towards label A, turns out to be much lower when looking at actual primary energy consumptions of dwellings. This could lead to a miscalculation of payback times of the measures for improving the energy efficiency of the dwelling and the targets that have been set for primary energy as well as CO_2 reduction might not be realistic looking at actual energy consumptions. It was found out that even by refurbishing the whole Dutch dwelling stock to a label A (which is an unrealistic assumption), the actual primary energy savings cannot yield most of the current targets. However, if the theoretical consumptions are considered, most of the targets are achievable. The targets for gas consumption and reduction in CO_2 emissions turned out to be similarly problematic.

7 Implication of the findings

The energy performance certification of existing dwellings is considered to be an essential element of the European energy efficiency policies. This research has shown that a policies that are only based on improving the energy efficiency of dwellings and the heating and cooling services most likely will not lead to the energy and CO2 reduction goals as formulated. This is mostly due to the fact that in very bad performing dwellings the energy use is not as high as expected due to a lower comfort level (behaviour) and in very high classified dwellings not as low as expected due to lacking performances of the buildings and services (building control) and the rebound effect (behaviour).

Before renovation of bad dwellings the actual energy consumption and use of the dwelling should be investigated before one can say something about the potential savings. Maybe not all the provided comfort in renovated dwellings is desired or actually consumed. Whit an adjusted heating behaviour more saving could be achieved. To reduce the CO2 emissions the use of PV panels for the provision of domestic electricity use seems very effective.

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Evolving Legal Strategies for Sustainable Urban Construction in Nigeria.

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Abstract:
In Nigeria, the discovery of oil and economic growth precipitated a mass exodus of citizens to urban areas as agriculture was abandoned in favor of city life. Unfortunately, massive corruption in government has occasioned a failure to observe urban planning laws culminating in indiscriminate, unregulated construction and unplanned cities. Overpopulation, flooding, spread of diseases and increased criminal activities characterize such unplanned cities. The neglect of government to supervise and enforce building regulations has resulted in a spate of collapsed buildings in Nigeria's built environment. Poor governance in Nigeria and the resultant economic downturn have fostered a situation where most citizens choose to save the cost of construction by employing unqualified builders to construct infrastructure instead of building experts. The unqualified builders, in a bid to cut costs, resort to substandard building materials thus leading to collapsed buildings, loss of life and properties. This paper argues that for construction in Nigeria to be sustainable, there is a need to draft new laws to reflect new developments and evolve ways of enforcing the laws consistently.The paper examines whether a paradigm shift in the socio-economic policies of government can improve the economy and reduce or eradicate the phenomenon of collapsed buildings.

Key Words:
Building regulations, Legal strategies, Nigeria, Sustainable construction, Urban planning

1 Introduction

Nigeria is afflicted by multifarious problems ranging from widespread corruption, lack of basic socio-economic infrastructure, insecurity, high rate of illiteracy and low life expectancy. The dearth of the basic necessities of life such as food, clothing and shelter is a most worrisome trend. A vast majority of Nigerians live below the poverty line and are therefore unable to meet the expense of providing adequate and enduring shelter for themselves (Adekoya ,C, 2009,37) while a lot of those who can afford to build their own houses resort to the use of substandard building materials in a bid to reduce the expenses associated with erecting a building.The failure of the Nigerian government to adequately enforce town or urban planning laws has led to the indiscriminate construction of houses in violation of extant laws and has engendered the growth of unplanned cities and towns thereby fostering urban chaos(Olujimi,J, 2009) as well as

avoidable deaths occurring from collapsed buildings. The prospects of achieving sustainable construction in a planned built-up environment appears bleak as an increasing number of Nigeria's surging population migrate from rural areas to the urban areas in search of better conditions of living as opposed to reliance on agriculture thereby putting a pressure on the hard-pressed space and resources available in the cities.
This paper examines from a legal perspective, how some semblance of order can be restored into Nigeria's urban environment such that sustainable construction will become a reality in Nigeria. This paper is divided into four parts excluding the introduction and the conclusion. The first part gives an insight into the legal framework regulating urban construction in Nigeria; the second part highlights the impediments to effective urban planning and sustainable construction in Nigeria; the third part discusses the essence of planning law while the fourth part identifies the legal strategies needed to attain sustainable construction in Nigeria.

2 Legal Regime Of Urban Construction In Nigeria

There is presently a plethora of statutes regulating building development; housing and regional planning matters in Nigeria and an overview of the statutes is apposite. The Nigerian Urban and Regional Planning Act [1]stipulate the types and levels of physical development plans to be executed in Nigeria. At the Federal level, the Act provides for a regional plan; a sub-regional plan; an urban plan and a subject plan with similar plans also existing at the State and Local levels.[2] Section 2 of the Nigerian Urban and Regional Planning Act defines the responsibilities of the Federal Government of Nigeria with regards to matters of urban planning and development and these include preparation and implementation of the National Physical Development Plan; the formulation of urban and regional planning standards for Nigeria as well as the promotion and fostering of the education and training of town planners and support staff amongst other duties. This Act establishes a National Urban and Regional Planning Commission which is responsible for supervising and monitoring the implementation of the National Physical Development Plan and development control[3] which responsibility is carried out through the Development Control Department of the Commission. This Control Department is vested with such powers that its approval shall be required for any land development in the federation.[4] It is pertinent to note that this Act is mindful of the impact of urban development on the environment and citizens as it provides that a developer's application for development may be rejected if in the opinion of the Control Department, the development is likely to have a major impact upon the environment, facilities, or inhabitants of the community or if the development contains such additional facilities which are not within the estimation of the Physical Development Plan for that community. The Act is however silent on how the discretion of the Control Department is to be exercised in approving or rejecting an application for development. The absence of such guidelines may be an avenue for arbitrariness. Of importance to this paper, is the power of the Control Department to demolish any building found to be defective with the cost of demolition to be borne by the erring Developer.[5]

[1] CAP N138 Laws of the Federation of Nigeria 2004
[2] Section 1, Nigerian Urban and Regional Planning Act
[3] Section 5, Nigerian Urban and Regional Planning Act
[4] Section 28(1), Nigerian Urban and Regional Planning Act
[5] Section 62, Nigerian Urban and Regional Planning Act

Another relevant statute is the Federal Housing Authority Act.[6] This Statute establishes the Federal Housing Authority, an agency of government having the responsibility of preparing a National housing program for Nigerians of different income groups in major cities and in every state across the nation and executing the program as may be approved from time to time by the Federal Government. This agency also has the duty of making recommendations to the Government on such aspects of urban and regional planning, transportation, communications, electric power, sewerage, and water supply development as may be relevant to the successful execution of the housing program approved by the Government.[7] The vision of this agency as publicized is to be the leading provider of housing and facilitator of access to sustainable housing solution in Nigeria and to become a model government agency while the mission is to be the leader in the provision of sustainable housing in Nigeria and to facilitate home ownership for all Nigerians (Federal Housing Authority, 2010). According to the official statement by the agency, the functions of the agency have further been expanded in the National Housing Policy to include the provision of sites and services for all income groups with special emphasis on the low income group; the provision of low income and rural housing in all states of the Federation and the Federal Capital Territory from funds provided by the Federal Government and other sources; the development and management of real estate on commercial basis in all states of the Federation and the Federal Capital Territory(Federal Housing Authority, 2010). Even though the Federal Housing Authority was established in 1973 as part of the Federal Government's commitment to make affordable housing accessible to all Nigerians, thirty –nine years later, more Nigerians are homeless as affordable housing has become far less accessible.

The need to effectively regulate the profession of town planning is underscored by the enactment of the Town Planners Registration Act.[8]The Act establishes the Town Planners Registration Council which is the body responsible for the registration of town planners and is charged with the duty of determining what standards of knowledge and skill are to be attained by persons seeking to become members of the profession of town planning and reviewing those standards, from time to time, maintaining discipline and controlling the practice of the profession in all aspects and ramifications.[9]

In the area of providing finance to facilitate urban development in Nigeria, the Urban Development Bank of Nigeria, a limited liability company was established by Law to foster the rapid development of urban infrastructure throughout Nigeria through the provision of finance and banking services.[10]This Bank may raise funds from off-shore sources such as the International Bank for Reconstruction and Development, the African Development Bank and other such sources to facilitate urban and infrastructural development projects in Nigeria. Where such funds are obtained by other entities, the said funds whether by way of general loans, tied loans, bilateral loans, or grants on government to government basis must be channeled through the bank and accordingly managed by the bank. [11]

[6] CAPF 14 Laws of the Federation of Nigeria 2004
[7] Section 3, Federal Housing Authority Act
[8] CAP T7 Laws of the Federation of Nigeria 2004

[9] Section 2 Town Planners Registration Act
[10] Section 3 Urban Development Bank of Nigeria Act, CAP U16, Laws of the Federation of Nigeria,2004
[11] Section 5 Urban Development Bank of Nigeria Act

The Federal Mortgage Bank of Nigeria is important in the provision of affordable housing to Nigerians as it has the function of providing long-term credit facilities to mortgage institutions in Nigeria at such rates and such terms as to enable the mortgage institutions to grant comparable facilities to Nigerian individuals desiring to acquire houses of their own.[12]

In a similar vein, there is in place a National Housing Fund established by the National Housing Fund Act to facilitate the mobilization of funds for the provision of houses for Nigerians at affordable prices; ensure the constant supply of loans to Nigerians for the purpose of building, purchasing and improvement of residential houses and more importantly, encourage the development of specific programs that would ensure effective financing of housing development, in particular low cost housing for low income workers.[13]

In view of the elaborate legal regime on regional planning and housing existing in Nigeria, it is startling that Nigeria consists of unplanned or poorly planned cities where majority of the citizens have no access to affordable housing.

3 Impediments To Effective Urban Planning And Sustainable Housing Construction In Nigeria

Olujimi noted that one of the key features of urbanization in Nigeria and other developing countries is rapid growth without any corresponding significant industrial expansion thus placing a high demand on the available infrastructure available for basic services and housing on one hand while also accelerating poverty (Olujimi,J, 2009). Thus, there is a need to improve basic facilities and utilities to correspond with the demographic changes (Ogundele,F,et al, 2011). According to Olujimi, an urban center or a city can only serve as an engine of development if properly planned and efficiently managed in the absence of which an urban sprawl materializes, characterized by "haphazard housing development in the urban suburbs where majority of the structures are without planning permit in an uncoordinated layout".[14]From this scenario, it can be concluded that the fundamental factor impeding effective urban planning and building control in Nigeria is the lack of political will on the part of government to implement development control measures manifested in the form of insufficient planning staff and lack of equipment such as development control monitoring vehicles(Olujimi,J, 2009). This position is re-echoed by Ogundele who noted that government's inadequate funding of development control characterized by the lack of vehicles as well as the unavailability of modern land use maps to reflect the trend of development are impediments to development control.

The prevalent incidence of corruption in the Nigerian society is also a great impediment to effective urban planning and sustainable housing. Corruption within the urban planning regulatory authorities has been responsible for double standards in approving or rejecting development plans as an applicant who has furnished some gratification is more certain to have his development plan approved than another applicant who has failed to do same. Furthermore, paying gratification to regulatory authorities has encouraged citizens to illegally convert residential buildings into mixed-use buildings such as residential and commercial,(Ogundele,F,et

[12]Section 5 Federal Mortgage Bank of Nigeria Act, CAP F16, Laws of the Federation of Nigeria,2004
[13] Section 2 National Housing Fund Act CAP N45 Laws of the Federation of Nigeria 2004
[14] Building control in Nigeria falls under the purview of the town planning authorities.

al, 2011) thereby altering the designated urban master plan. With regards to housing construction, the impact of corruption is seen when importers of building materials are allowed to import substandard materials and sell same into the Nigerianconstruction market culminating in the rapid collapse of buildings.

It has also been noted that the dearth of reliable information on demographic factors such as the population is a major obstacle to planning (Oduwaye, L, 2009). One of the fallouts of the discovery of crude oil in Nigeria was the steady relegation and neglect of agriculture as the mainstay of the economy. This resulted in mass movement of citizens from rural areas to urban areasin what Agbola and Agunbiade (2007) termed as an invasion. They state that population increase due to mass exodus from rural to urban areas causes unusual land and demographic pressure triggering an unprecedented demand for land. Accordingly, the invasion leads to uncontrolled and unorganized developments lacking basic infrastructure and facilities (Agbola T and Agunbiade, 2007)

The problems bedeviling urban planning and sustainable construction in Nigeria are succinctly stated in the findings of Oloyede, et al (2010) that the causes of building collapse in Nigeria include 'improper design, faulty construction methodology, poor town planning approval/development monitoring process; non-compliance with specifications/standards by developers/contractors; use of substandard materials and equipment; inadequate supervision or inspection/monitoring'. There is no gainsaying that without the proper enforcement of town planning laws as well as the enactment of strict development or building control laws, Nigeria's built-up environment will continue to be an unplanned concrete jungle bedeviled by constantly collapsing buildings.

4 The Essence Of Planning Law

Planning law governs the processes involved in getting planning permission for the erection or change of use of buildings.[15] The learned writer, Utuama believes that the essence of planning law lies in its "use as a law for analyzing and resolving conflicts in diverse use of land arising from their interaction one with the other by drawing up plans to indicate where and when development should take place; by devising policies to cope with current and anticipated problems in the use of land; the movement of the people and goods, and the quality of the environment" (Utuama,A.2006). As such, where planning laws do not exist or are not properly enforced, the repercussions extend beyond hapless citizens and have a very negative effect on the environment. In this regard, Utuama states that an environment can only be as friendly as the degree of land use planning to which it is subjected. Thus, he suggested, and rightfully so that planning law is of utmost importance in the protection of the environment, especially in a country like Nigeria whose major cities are heavily characterized by environmental imperfections amongst other issues of concern such as provision of housing and conservation of natural resources. He concluded his argument by advocating for a constitutional review that will make urban and regionalplanning a concurrent legislative matter, in the interest of developing a national, comprehensive and all-embracing land use planning system that will bring Nigeria into purposeful planning in response to national goals (Utuama , A.2006)

[15]http://www.unbiased.co.uk/glossary/letter_p viewed 29/06/2012

In addition to establishing a model urban planning law, there is a need to ensure sustainable construction in Nigeria. It has been observed by Isover that while standard building practices are guided by short term economic considerations, sustainable construction is based on best practices which emphasize long term affordability, quality and efficiency (Isover,2012). The importance of ensuring sustainable construction is underscored by the fact that buildings and construction works have the largest single share in global resource use and pollution emission. Apart from individual buildings, Isover further disclosed that poor patterns of building development often lead to congestion and inefficient use of land, resulting in greater energy consumption and travel time, loss of productivity, polluted runoff to surface water and wastewater treatment systems, loss of agricultural lands, fragmented habitats, and fiscal stress to local communities. Due to the implications for the environment, sustainable construction has extended beyond national boundaries and is now a global issue. According to Edward Schwarz, 'achieving sustainable construction requires a multifaceted worldwide approach by all nations, sustainable building practices must occur in every place, address a variety of problems, happen on many levels, work in various contexts ,respond to many needs and restraints, be applied at every scale and employ many disciplines'(n.d). The international dimension of sustainable construction and its impact on the world's environment is demonstrated by the United Nations Environmental Project (UNEP)'s Sustainable Buildings and Climate Initiative which is a partnership of major public and private sector stakeholders in the building sector working to promote sustainable building policies and practices worldwide.(UNEP)

In Nigeria, unfortunately, the attention is on the spate of collapsed buildings. Recently, the Director-General of Nigerian Building and Road Research Institute was reported as stating that the collapse of buildings had become too frequent and a source of worry to all professionals in the industry and that the effect on the economy and the loss of human lives had become a great burden on the nation(Amaefule,E,2012). The Director-General further stated the causes of collapsed buildings in Nigeria as failure to obtain building approval from relevant authorities, the activities of quacks in the building industry, the use of deficient materials and the absence of supervision by government authorities.

5 Evolving Legal Strategies

It must be observed that in spite of the problems associated with housing and construction, the Constitution of Nigeria contains certain provisions which are relevant to the issue of housing. Section 15 of the Constitution provides that the state shall secure full residence rights for every citizen in all parts of the Federation, The environmental objectives of the Nigerian government as stated in the Constitution is to the effect that the government shall protect and improve the environment and safeguard the water, air and land, forest and wild life of Nigeria.[16]The Constitution further provides that suitable and adequate shelter, suitable and adequate food, reasonable national minimum living wage, old age care and pensions, unemployment and sick benefits and welfare of the disabled are provided for all citizens. The crucial shortcoming of these rights guaranteed by the Constitution is that the same Constitution renders the rights unenforceable thus rendering these vital rights as rights of mere paper value. There is thus an

[16]Section 20 Constitution of the Federal Republic of Nigeria.

urgent need to amend the Constitution to change the status of the right to shelter and other associated rights to enforceable rights.

Particularly, it is strongly suggested that there must be a paradigm shift in the socio-economic policies of the Nigerian government. At present, the fundamental obligations of the Nigerian government to the citizens as enshrined in Chapter II of the Nigerian Constitution titled 'Fundamental objectives and directive principles of state policy' have remained unfulfilled leading to a loss of confidence in the government and fostering a situation where citizens have to resort to self-help in the absence of government provision . The absence or irregular supply of basic facilities such as water, electricity and good roads in urban centers in Nigeria needlessly drives up the cost of construction as citizens are compelled to find the means of providing these amenities for themselves. This encourages unethical practices as certain individuals attempt to cut the cost of construction by using cheap, sub-standard construction materials and also cutting back on the standard measurements required to make solid concrete thereby creating a potential risk and negating the very essence of sustainable construction. The high rate of inflation in the economy and the loss of purchasing power of citizens have also brought about a situation where most citizens employ artisans to design and build houses as opposed to consulting professionals such as Architects, Quantity Surveyors and Civil Engineers. It is submitted that this situation does not bode well for sustainable construction and housing in Nigeria. If the government makes an effort to fulfill its economic objectives, poverty will be reduced and cutting corners by citizens to achieve their housing dreams will be greatly reduced. For instance, the Nigerian Constitution states that it shall be the duty of the government to control the national economy in such manner as to secure the maximum welfare, freedom and happiness of every citizen on the basis of social justice and equality of status and opportunity.[17]Similarly, the Constitution further provides that the government shall harness the resources of the nation and promote national prosperity and an efficient, dynamic and self-reliant economy. Unfortunately, this is presently not the case as Nigeria is nowhere near a self-reliant economy. Notwithstanding the fact of being the tenth largest producer of oil in the world, the Nigerian economy is solely dependent on imports as most local industries have shut down due to an unfriendly business climate. A situation where construction materials are mostly imported also drives up the cost of construction thereby making sustainable construction in Nigeria a distant dream.

There is a need to draft new laws on building practice which will strictly specify the use of authentic and environmentally friendly building materials in the construction industry. This will achieve the dual objective of ensuring sustainable construction and also protecting the environment. To make this possible, there must be stricter supervision not only by the relevant government agencies but also by professional institutions having a stake in construction in Nigeria.This position finds credence in the words of I.O.Smith, (2006) a renowned Land Law expert,

> Although planning control is not necessarily conterminous with environmental law, it is apt to say they are complementary. Land use has a critical impact on the environment and sustainable development. The issue of environmental protection is a mirror of the use to which land water and air have been subjected by man.While environmental

[17] Section 16(1)(b) Constitution of the Federal Republic of Nigeria 1999

> protection may be the end,planning is a veritable instrument for achieving a healthy environment and sustainable development.

One of the main causes of insufficient housing in Nigeria is the prohibitively high cost of building materials as Nigerian buildings are basically made up of concrete as opposed to developed countries where construction is mainly done with bricks and wood. The high demand for cement used in making concrete blocks and the corresponding astronomical increase in the price of cement has made housing unaffordable for Nigerians especially in a country where over half of the population lives below the poverty line. Inadequate housing leads to the establishment of slums in the urban centers thereby creating an urban planning nightmare. Likewise, the unrestrained continued use of cement in building is antithetical to sustainable construction as well as sustainable environment. Thus, there is need for new regulations in this regard. The use of mud bricks which was the predominant building component in Nigeria in the past needs to be revisited and adapted to modern construction techniques for the best results.

6 Conclusion

Nigeria's built up environment is in a state of untidiness as existing urban planning laws are flouted with impunity while regulatory authorities are unable to monitor development control let alone implement the laws effectively. The high rate of poverty in Nigeria and the needlessly high cost of purchasing construction materials have further contributed tothe problems associated with construction in Nigeria. As a result, Nigeria is contending with the phenomenon of collapsed buildings and unrestrained environmental pollution in an age where the world is focused on achieving sustainable construction and environmental sustainability.Unfortunately, the government has not manifested any intention to remedy the situation. There is a pressing need to address the problems of housing, urban development and sustainable construction in Nigeria before a major crisis results as the consequence of such crisis will unbalance the West African sub-region and have its effects felt all over the world as Nigeria is by far, Africa's most populous nation. To avert a housing crisis in Nigeria, the government's objectives must be totally focused on the welfare and best interest of the citizens of Nigeria as opposed to the present situation where citizens are unable to identify any government measures to address the myriad of problems afflicting Nigerians.

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Owner-occupiers and the quality of their dwellings

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Abstract:
Home-owners are in principal responsible for maintaining the physical quality of their dwellings. It is in their own interest to do this in an adequate manner, but all kinds of constraints can and do occur in practice. Lack of financial means and insufficient (technical or practical) knowledge are only two of the possible barriers. The quality of owner-occupied housing sector exceeds the individual interest, there are also general concerns to consider. Qualitative seriously substandard owner-occupied dwellings can have various negative effects on the neighbourhood. This paper is based on an on-going research project on the quality and maintenance situation of the owner-occupied sector in the Netherlands. Within this project almost 4.000 Dutch home–owners have recently been questioned about issues concerning the quality of their dwelling, the maintenance actions they undertake, the problems they encounter and the help or advise they would like to get. This paper presents the first results. The results especially will give insight in the way home-owners cope with maintaining the quality of their dwellings. Are they doing an adequate job or are interventions of the Dutch authorities (for parts of the sector) necessary?

Keywords:
home-owners, housing quality, housing stock, maintenance, policy instruments

1 Introduction

This paper deals with the physical quality of the owner-occupied sector in the Netherlands. During the last decades the owner-occupied sector has increased considerably. The principal view of the central government is that home-owners themselves are responsible for the quality and maintenance of their dwellings. Governmental support in general is not necessary. In a growing number of municipalities however the quality of the owner-occupied housing sector has become a matter of concern during the last years.

As this paper shows home-owners in general are perfectly able to maintain the quality of their dwellings. Nonetheless there are some 'problem segments', where the owners are not able (or willing) to invest in maintenance and repair. Especially local authorities observe that the physical quality of parts of the older owner-occupied stock is far from satisfying and partly seriously substandard. Various reasons to intervene can be named. In the first place local authorities have the statutory requirement (based on the Housing

Act) to supervise the housing quality. The building regulations establish an minimum level for existing dwellings. If a dwelling falls below that level the local authorities can summon owners to improve the situation. In general this only happens when the safety or health of the occupiers themselves and/or neighbours are endangered. Besides that the owner-occupied sector is of importance for the liveability of neighbourhoods. A row of dilapidated owner-occupied houses in a street could have serious negative effects on the neighbourhood. Municipalities can play a role to prevent that such problems occur. Furthermore national government and municipalities have established ambitious goals to reduce CO_2 emissions. In order to realise these ambitions the energy performance of the existing dwelling stock has to be improved on a large scale. To get the owner-occupiers on the move to invest in energy saving measures an important role is foreseen for local authorities. Because of these mix of reasons seven municipalities have decided to join in a research project that focusses on the question: "What is the quality of the owner-occupied sector and how can local municipalities act to improve the quality of the private owned housing stock"? This paper reports about the first findings of the research project. The paper starts in chapter 2 with a short overview of the owner-occupied housing stock. Chapter 3 elaborates on the 'problem segments' and the efforts local authorities undertake to intervene. Section 4 focuses on the overall perception on housing quality of the owner-occupier. In section 5 first conclusions are presented.

1.1 Research approach and methodology

The research project is being carried out by OTB Research Institute for the Built Environment (Delft University of Technology). Besides the seven municipalities the Dutch Stimulation Fund for Housing (SVn) and the Nicis Institute participate in the project. SVn administers funds that are provided by (local) authorities and invests (via low rented loans and revolving fund constructions) in the quality of the housing sector. The Nicis institute is the Knowledge Institute for Dutch Cities. The project focusses on the quality of the owner-occupied sector as a whole but also on the 'problem segments'.

Various research methods are used. In case studies in the seven municipalities the efficiency is explored of the policy instruments that are used to solve the quality backlogs in the 'problem segments'. Via desk research and in-depth interviews the extent of the problem and the (cost) effectiveness of the policies in each municipality are described and analysed. The interviews are being held with representatives from the municipal councils, service counters, financial organizations, Home-Owners' Associations, etc.
To get insight in the overall situation in the owner -occupied sector a general survey was recently carried in the seven municipalities. Via a multi staged sampling process owner-occupiers were in selected each municipality. A distinction was made between multi and single family dwellings and four construction periods (one pre-war and three post-war periods). Some 26.000 owner-occupiers were approached with the invitation to fill in an internet questionnaire. The questionnaire was divided in the following sections: characteristics of dwellings and occupants, perceptions of housing quality, operation of Home-owners' Associations, maintenance work and housing repairs in the recent past and near future and energy-use. Fifteen per cent of the owner-occupiers have completed the questionnaire.
With respect to contents the research project focusses solely on the situation in the Netherlands. In a later phase the results and insights will be placed in an international

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perspective. Although emphasis lies on the results of the general survey, the paper touches also upon the 'problem segments' and the municipal instruments used to tackle the problems.

2 The owner-occupied sector

Table 1 gives an overview of the developments in the Dutch housing stock over the last forty years.

Table 1. Development of the housing stock by tenure (in %)

(Source: ABF Research B.V. Syswov 2011)

	1971	1980	1990	2000	2010
Owner-occupied	35,1	40,7	45,3	52,5	59,3
social rented	37,1	37,9	38,5	35,8	31,7
Private rented	27,8	21,4	16,2	11,7	9,0
Total	100,0	100,0	100,0	100,0	100,0

Until some decades ago the importance of the Dutch owner-occupied sector lagged behind those in neighbouring European countries. In the meantime this situation has changed. The last decades showed a remarkable growth of the owner-occupied housing stock. In the last forty years owner-occupation grew from some 35% up to almost 60% at present. The private rental sector declined from 28% to 9% at present. The last two decades the relative importance of the social rented sector decreased from 38% to almost 32%. The growth of the owner-occupied part was the combined result of a strong absolute as well as relative increase of new construction (the lion share of newly built housing construction has been owner–occupied) and of the selling out of rented dwellings. In the same time the production of rented dwellings dropped while demolition of social rented dwellings showed a steady increase.
There are huge local differences in ownership proportions. Especially in the larger municipalities the relative importance the owner-occupied sector is far lower than the Dutch average. In the municipalities that participate in this research project 40% to 50% of the housing stock is owned by the occupiers.

The owner-occupied sector in terms of age and dwelling type is diverse. Table 2 gives information on the age of the owner-occupied and rental housings sector in categories. The table shows that the owner-occupied stock is relatively young.
None the less - as is the case throughout Western Europe - the Dutch housing stock is ageing. After the mass construction following WW II the addition of new dwellings has now dropped to (far) less than 1% annually. Though the Dutch housing stock is still relatively young – over three-quarter of the stock was produced in the fifty years after WW II – the ageing process is continuing. In 1973 almost 60 per cent of the housing stock was less than 25 years old. In 2010 this percentage has changed to 30.

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Table 2. Age of the owner-occupied stock compared with the rental housing stock (in %)

(Source: ABF Research, Syswov 2011)

	Owner-occupied stock		Rental housing stock	
	N	%	N	%
Pre war	931.906	21,9	542.347	18,6
1946-1970	902.041	21,2	1.000.519	34,3
1997-1990	1.320.973	31,0	977.691	33,5
After 1990	1.099.699	25,9	397.260	13,6
Total	4.254.619	100,0	2.917.817	100,0

The owner-occupied stock consists predominantly (85%) of single-family housing. In the rental housing stock singe-family houses and multifamily houses are represented proportionally.
Again there are important local differences. In some municipalities that participate in the research project (e.g. The Hague) a large part of the owner-occupied stock is pre-war and situated in multifamily houses. In the Netherlands owners of apartments in multifamily houses must co-operate in an Owner-Occupiers' Association. The joint owners are responsible for maintaining the physical quality of the common parts of the building (e.g. façade, roof, staircase and elevator). According to the Apartments Act and the Housing Act apartment owners in an Owner-Occupiers' Association should appoint an administrator, meet at least once a year to discuss maintenance and reserve funding for (future) maintenance and major repairs.

3 Problem segments and policy instruments

From 1901 on (the year the first Housing Act came into force) local authorities have been active guarding the quality of the owner-occupied housing stock. In the 1970's and 1980's the quality of private housing became a political issue on a national level. Especially the quality of the pre-war housing sector was a point of concern. Extensive maintenance backlogs in the owner-occupied sector were improved with government funding. Based on the Urban Renewal Act and financed by the Urban Renewal Fund large scale urban renewal projects were developed with subsidy schemes for owner-occupiers. Besides the subsidy track, some local authorities bought private dwellings and renewed them.
Since this approach proved to be successful, the (predominantly pre-war) Urban Renewal assignment was considered to be completed (MVROM, 1992), the Urban Renewal Act was withdrawn, and the Urban Renewal Fund came to an end.

Until the year 2000 the quality of the Dutch Housing stock was monitored with 5 yearly Qualitative Housing Surveys. The last survey (held in 2000) showed that the Dutch owner-occupied stock in general was in a relatively good state. This was the sign for the national government to end its active involvement in the owner-occupied housing sector. The problems were solved and the minister responsible for the housing sector explicitly pointed out that taking care of the quality is the responsibility of the owner

(MVROM, 2003 en 2006; Dekker, 2005). All the same in recent years some subsidy and VAT reduction programs have been installed to promote energetic saving measures in the owner-occupied sector. A goal often combined to support the struggling building sector in these times of economic crisis.

3.1 Problem segments

Housing quality of the owner-occupied stock also has not been on the agenda of most local authorities the last decade. In most cases this can be explained because they did or do not see the need. Others however have argued that municipalities have lost the sight on the quality of the housing stock (Goudriaan and Ten Napel, 2004). In 2005/2006 research was carried out for a broad consortium of organizations in the construction and real estate sector. They showed concern about the quality development of the privately owned housing stock and the fading governmental attention. That research has shown that - although in general the situation in the owner-occupied sector was relatively good - there were some 'problem segments' where attention is needed (Meijer and Thomsen, 2006). As this on-going project proves the need for attention has not diminished. A growing number local authorities see the need to pay attention to the quality situation in some parts of 'their' owner-occupied housing sector. Even though many local authorities miss actual and exact information about the physical housing quality, the following trouble spots can be identified.

The quality backlog is relatively great in pre-war (single-family) dwellings in smaller municipalities and in multifamily houses (built before 1945 and in the period 1945-1970) which predominantly are located in larger municipalities (Meijer and Thomsen. 2006).
The (pre-war) single family houses can be found in relative sparsely populated areas, where the economy is shrinking. In these areas the demand for owner-occupied houses is low or almost absent. Under these circumstances the current owners are not prepared - but more important often not financially able - to invest in the upkeep of their dwellings. The houses that already are in a bad state of repair deteriorate further.
The maintenance backlogs in pre-war and early post-war multifamily housing in the larger municipalities are caused by a combination of several factors. In the recent past many apartments haven been individually sold (by housing associations or private investors) to the renters. The starting quality of these dwellings was already low and most of the buyers belong to a lower-income group. To worsen things the Owner-Occupiers' Association in which the buyers should co-operate carrying out maintenance on the communal parts of the multifamily house was (and is) in most cases not functioning. This means: no co-operation, no proper communal management, no meetings to plan future maintenance and no reserve fund for common repairs and maintenance.
These two segments need attention in terms of improving the physical quality. The strong increase in the percentage of elder people could influence the maintenance quality of the Dutch owner-occupied stock in the near future on a more general level. In general the population is getting older and owner-occupiers stay far longer in their dwellings. These occupants are reluctant or find it more and more difficult to invest in the maintenance of their dwelling. The current economic crises could also have a negative effect. The value of owner-occupied housing is declining and average incomes

are falling off. This makes is it not attractive (or sometimes impossible) to invest in the dwelling.

As mentioned briefly before in section 1 the national government and municipalities have established ambitious goals to improve the energy performance of the Dutch housing sector. In the owner-occupied sector the potential for energy saving is huge (Meijer et al, 2009). More than 60% of the owner-occupiers believe that it is quite feasible to lower the energy use (either by taking measures or by changing behaviour). Around 25% up to 30% has the opinion that more energy saving is not possible and the remaining 10% has no idea.

Of an entirely different order are problems with rotten wooden pile foundations. An estimated 750,000 dwellings (especially in the western parts) in the Netherlands are built on a wooden pile foundation. The number of residential buildings with (hidden or acute) foundation problems has been estimated at about 200,000 up to 250,000. This could be doubled in in the coming decades if no adequate measures are taken. At least half of these will have to be provided with a new foundation. The repair costs vary from € 45,000 up to € 60,000. Many owner-occupiers face (and probably will face) this problem. These are expenses they can impossibly afford. Help and support (from authorities and or housing associations) is needed to tackle the problems.

3.2 Policy instruments

On a national level some regulatory steps have been taken special aimed at owner-occupied multifamily housing. In 2008 the Apartment Act has been changed and from that time on Owner-Occupiers' Associations are statutory obliged to have a maintenance fund. When an apartment is sold it is obligatory to provide information about outstanding balances (from the other owners) and current contents of the maintenance fund. No legal arrangements have been made about the height of the fund or planning of major repairs. In 2011 the Housing Act has been changed in order to give municipalities the power to act to activate non-functioning Owner-Occupiers' Association. In the case of imminent major maintenance backlogs it is possible for local authorities to intervene.

To stimulate energy saving measures in the built environment the covenant More with Less has been negotiated between the government and stakeholders in the construction industry and both the social as owner-occupied housing sector (2008/2009). One of the instruments is that owner-occupiers could get subsidy to determine the energetic performance of a dwelling and the measures that could be taken to better the situation. This subsidy program has stopped in 2011.

In the meantime more and more local authorities have developed specific instruments to tackle the problems as mentioned above. In some cases the instruments are specifically aimed at Owner-Occupiers' Association Act and in other cases on certain types of repair (e.g. the façade or energy saving measures). In many cases local authorities aim at combined results. For instance when foundations are being replaced or restored it is also logical to take measurements to improve the energy performance (e.g. insulating the ground floor). The case study research that is being carried out in this project analyses the effectiveness and efficiency of the instruments local authorities have brought into action. In general these instruments are aimed at stimulating the owners through

communication and financial incentives. The overall effectiveness and efficiency of these instruments seems to be rather low. Local authorities invest relatively large financial and personal efforts whereas the yields are low. In depth analyses of the results will in the near future be reported in separate papers and articles.
In the next chapter the 'problem segments' are left behind and attention will be paid to the situation in the owner-occupied sector in general.

4 Home-owners and the quality of their dwellings: overall view

This section presents the first results of the survey that has been carried out in this project. The survey was conducted (end of last/beginning this year) under owner-occupiers in the seven participating municipalities. In total almost 3.800 questionnaires were returned.

4.1 Considerations in advance

The results presented in this chapter are based on a work in progress. These general results so far have been presented only to the local authorities. The data is representative on a municipal level; no further breakdowns (building age and housing type) have been published yet. The data sketch a good overall picture of the situation in the seven municipalities as with respect to the way owner-occupiers are dealing with the (physical) quality of their dwellings. The results are comparable in the seven municipalities. The data presented were gathered in The Hague.

Another consideration to be made is the representativeness of the home-owners that have participated in the survey. Owners that participate in this kind of research are relatively more enthusiastic and satisfied by the importance of such kind of research. First analyses (on the available data on a national level) has shown that the average respondent is higher educated than the average Dutchman. The income level however seems not to deviate from the average income level of the Dutch home-owner. In order to be able to draw more conclusions about the representativeness of the owners that have participated, comparisons with municipal data should be made. In many cases however it is questionable if there is reliable data available about the personal characteristics of home-owners on a municipal level.

4.2 Perception of quality

The home-owners were asked to assess the quality of their dwellings and neighbourhood. This section deals with the quality assessments of the owners themselves. No physical inspections (by a professional) of the dwellings were held. This could produce a biased picture. The judgment of an owner results does not always corresponds with the actual state of repair.
Three quality aspects are taken into account:

- State of repair of the outside (exterior) and inside of the dwelling.
- Ease of use and comfort of the dwelling.
- Living conditions (residential area).

Each of these three aspects is divided in subcomponents. Figure 1 gives an illustration of the assessments of the outside of the dwelling.

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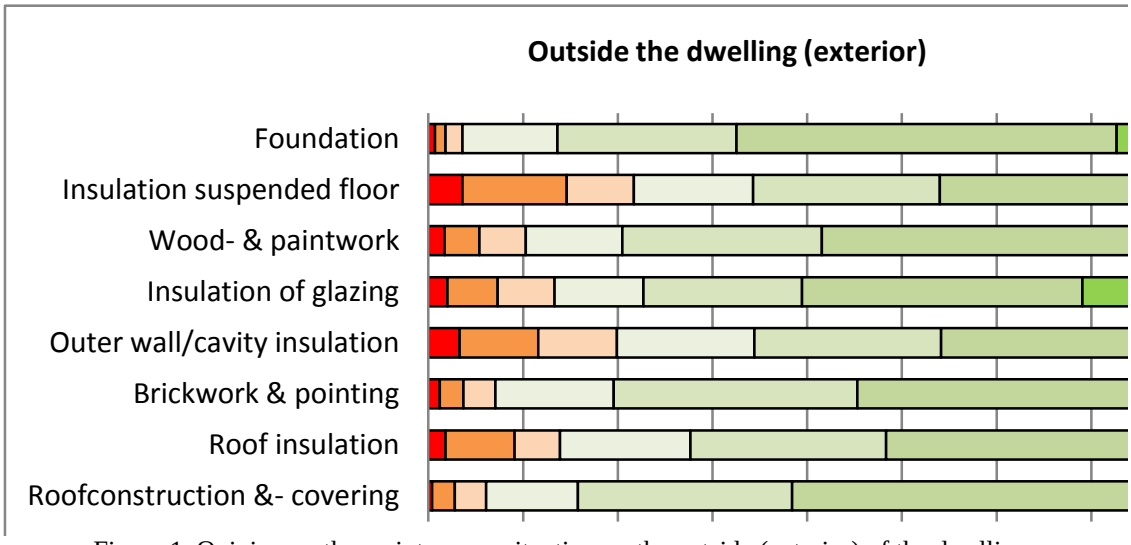

Figure 1. Opinion on the maintenance situation on the outside (exterior) of the dwelling
1-2 = bad 3 -4 unsatisfactory 5 = almost satisfactory
6 -7 satisfactory 8 -9 good 10 = excellent

Most owner-occupiers are satisfied with the exterior of their dwelling. More than half of them asses the state of repair as being good up to even excellent. Components that score relatively low are the insulation of the dwelling. Roughly 20% of the owners consider the insulation level - especially of the ground floor and outer wall – as unsatisfactory.
To a large extent these correspond with 'national' data: 83% of all Dutch households (fully) disagree with the proposition *"my dwelling is in a bad state of repair"* (AFB Research, 2010). These 83% include households that rent. This group could have influenced the results in a negative way. The fact that there are insulation backlogs (especially with respect to the ground floor and façade) is also backed by data gathered on a national level (Meijer, et al, 2009).

As figure 2 shows home-owners are even more satisfied with the inside of their dwelling than with the outside components.

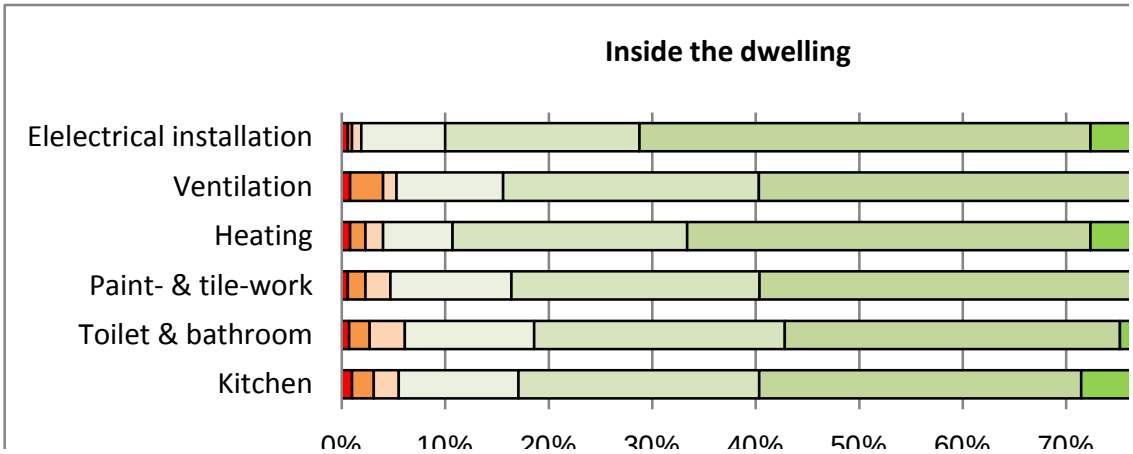

Figure 2. Opinion on the maintenance situation inside the dwelling
1-2 = bad 3 -4 unsatisfactory 5 = almost satisfactory
6 -7 satisfactory 8 -9 good 10 = excellent

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The overall judgement of the owners is good up to excellent. Less than five per cent of the home-owners is dissatisfied with some components inside their dwelling. This is in accordance with other data that is gathered on a national level: 97% of the Dutch home-owners are (very) satisfied with their dwellings (AFB Research, 2010).
The ease of use and comfort is also being considered as 'good'. Especially size and lay out of the dwelling prove to be (quite) satisfactory. Only the insulation aspects (see also figure 1) have in general a relatively less good score.

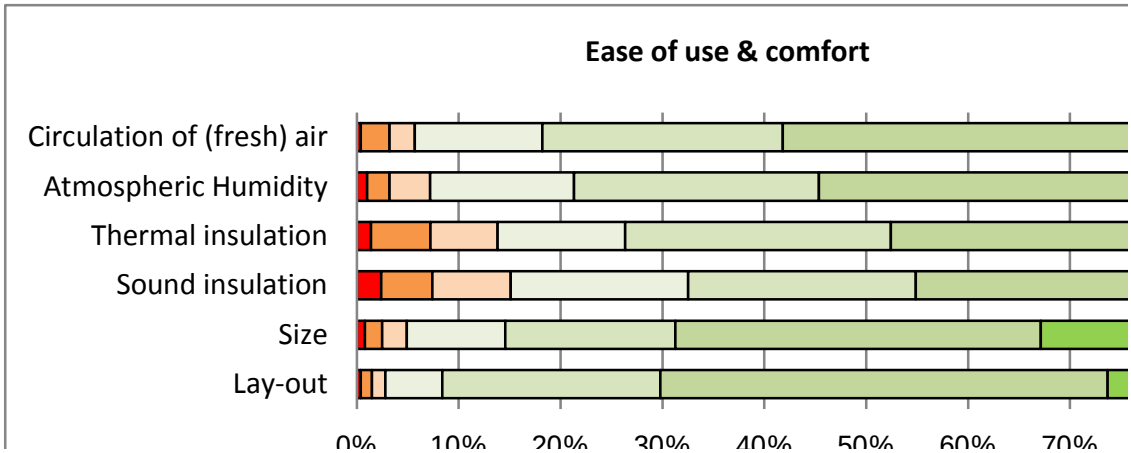

Figure 3. Opinion on ease of use and comfort of the dwelling

1-2 = bad 3 -4 unsatisfactory 5 = almost satisfactory
6 -7 satisfactory 8 -9 good 10 = excellent

The National Housing Survey (AFB Research, 2010) shows that 86% of all households (fully) agree with the proposition; *"the lay-out of my dwelling is OK"*. Other relevant outcomes are

- *"My dwelling is too small"*: eighty per cent of all households (totally) disagree.
- *"My dwelling is too large"*: almost three quarter of all households(totally) disagrees

Figure 4 shows how owner-occupiers consider the living conditions in their direct environment (street and neighbourhood).

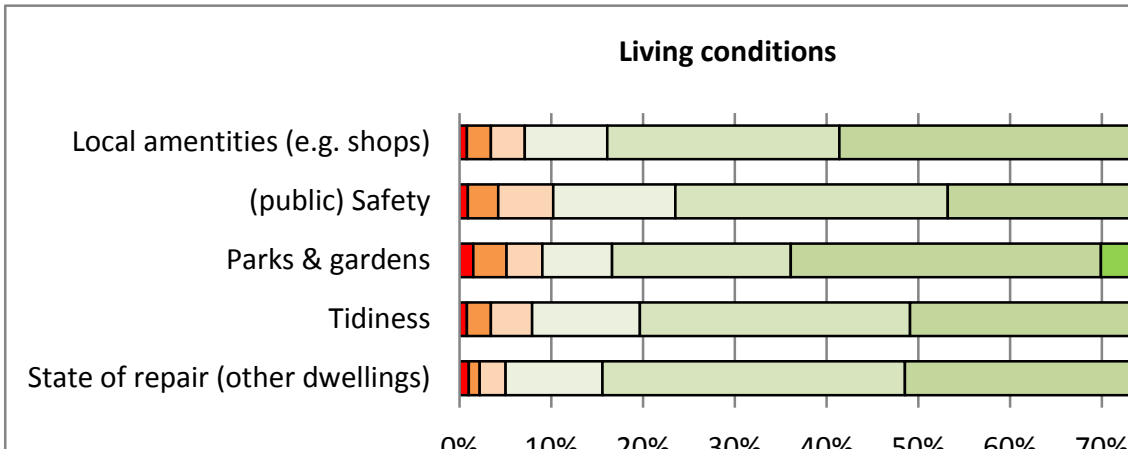

Figure 4. Opinion on living conditions

1-2 = bad 3 -4 unsatisfactory 5 = almost satisfactory
6 -7 satisfactory 8 -9 good 10 = excellent

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The lion share of the home-owners is satisfied with their direct living environment. Nonetheless some 10% consider the (public) safety, green space and tidiness as being insufficient.
In the Netherlands as a whole around six per cent of all households is (very) unsatisfied with their direct environment (AFB Research, 2010).

The overall picture that emerges from the data presented in the figures 1 through 4 is that owner-occupiers in general are (very) satisfied with their dwelling.

4.3 Maintenance and repair activities

The average home-owner appears to be quite active maintaining their dwelling. Maintenance activities have been carried out in more than three quarters of the dwellings (over a period of 2 years). The most important reason for owners who have not done anything is because it was not necessary (see figure 5).

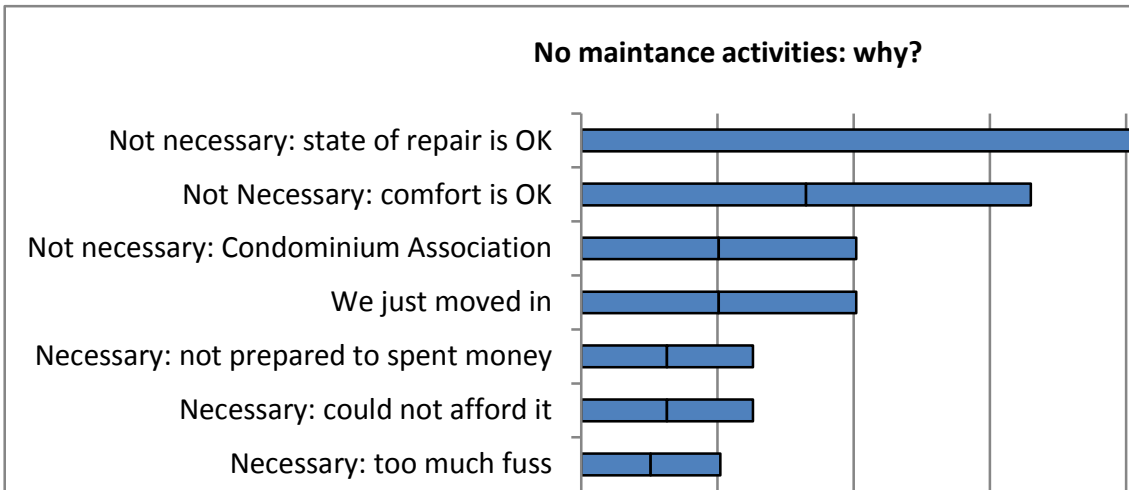

Figure 5. Reasons why no maintenance activities have been carried out the last 2 years

The reason most mentioned is that the state of repair of the dwelling is in order. In some 10% of the cases the Owner-Occupiers' Association deemed it not necessary to carry out maintenances jobs. In relatively few dwellings (5% to 7%) necessary maintenance has not been carried out because a lack of money or skills.

In the questionnaire a distinction was made between three groups of maintenance (or repair) activities:

- Work on the outside (or exterior) the dwelling (e.g. repair of roof or outer wall; wood- or repaint work).
- Work on the inside of the dwelling (e.g. repair or replacement of kitchen, toilet or bathroom, repaint- or retile-work).
- Installation/insulation work (e.g. replacement of the boiler. insulation of roof, glazing, floor or wall).

Figure 6 illustrates that work on the exterior of the dwelling has had priority during the last two years.

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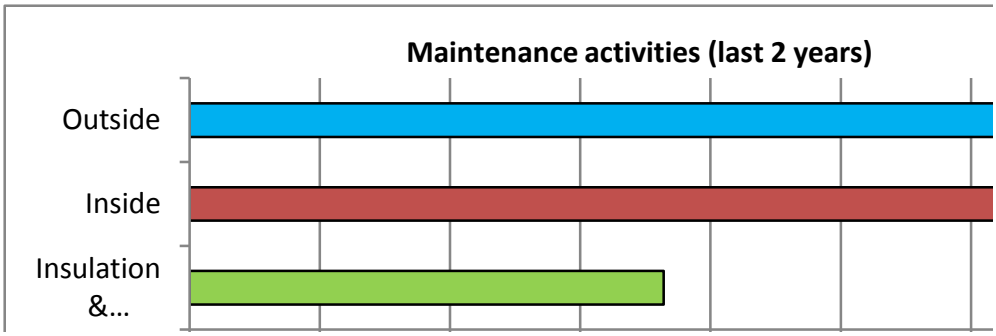

Figure 6. Maintenance activities (categorized) that have been carried out the last 2 years

Three-quarter of the owner-occupiers that have carried out maintenance work did some jobs on the exterior of the dwelling. Particularly the paint and woodwork on the outside has been repaired (done by 70%). Another thirty per cent of the owner-occupiers has repaired their roof-covering (construction) and/or gutters and drainpipes.
Although a lot of work has also been done inside the dwelling, the percentage of home-owners that paid attention to the inside is a bit lower than those who worked on the exterior of the dwelling. Of the owner-occupiers who made repairs inside the dwelling:

- Around seventy per cent did paint, (re)paper and or tile jobs.
- Some 35% repaired, improved or replaced their toilet and or bathroom.
- Followed by 25% who did some work on their kitchen.

Comparatively the least attention has gone to work on installations and/or insulation. Two thirds of the people who did some work inside the dwelling replaced their central heating boiler. About 20% of the owners made improvements on the insulation of their glazing and roof. The extent of these improvements is not known. Hardly any owner-occupier (less than 1%) has installed a renewable energy source in their dwelling during the last 2 years (e.g., solar panels or a heat pump).

The main reasons to carry out repair and maintenance jobs are sketched in figure 7. Logically, the reasons differ per category.

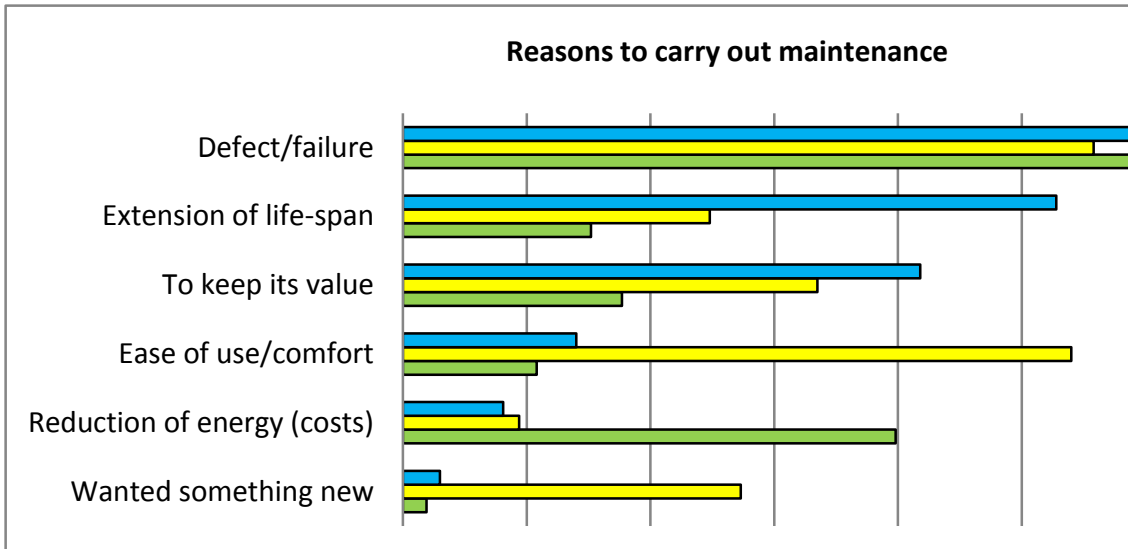

Figure 7. Reasons to carry out maintenance and repairs (in categories)

For all three categories of maintenance jobs the fact that the building component failed or was defect has been the most important reason to undertake action. Additional reasons to carry out maintenance on the exterior of the dwelling are to prolong the lifespan and to keep the value of the dwelling. 'Inside jobs' are carried out to enlarge the ease of use and the comfort of the dwelling. Insulation- or installation work is done in order to reduce the energy use of the household (and subsequently lower the energy bill).

4.4 Investments

The data about investments (per job and category) is still being analysed. Other recent research shows (see table 3) that an average home-owner invests € 4,760 in his/her dwelling on an annual basis (Vereniging Eigen Huis, 2011).

Table 3. Annual expenditure of an average homeowner on maintenance and improvements (in €)

(Source: Vereniging Eigen Huis, 2011)

	Average expenditure on an annual basis in €
Regular maintenance	2,022
Major repairs	1,740
Improvements	996
Total	**4,758 (= 397 a month)**

Regular maintenance: e.g. painting, garden maintenance, maintenance central heating boiler, small reparations on the roof, replacement of a faucet.
Major repairs: e.g. replacement of roof gutter, replacement of boiler, replacement of roof topping, replacement of electrical installation.
Improvements: e.g. placing of double glazing, floor- or roof insulation, dormer, construction of a carport.

On the basis of the Dutch Real Estate Appraisal Act it can be calculated that an average owner-occupied house has a value of € 263,000. Every year an average owner-occupier invests almost € 4,800 in his dwelling. This accounts for more than 1.8% of the average value. A little more than € 2,000 is invested in regular maintenance. These repairs (and their costs) are recurring on a frequent basis. In major repairs an amount of well over € 1,770 is yearly invested on average. Relatively the smallest amount (€ 1,000) is spent on improvements on the dwelling (Vereniging Eigen Huis, 2011).

The current research project shows that a small minority of the owners (less than 10%) lends money to pay for the expenses for repair and management of the dwelling. In these cases the mortgage on the dwelling is raised and/or surplus value is used.
The vast minority pays with their own money (savings). In the case of multifamily housing a relative important part of the maintenance and repair cost on the exterior of the building is paid from the maintenance fund of the Owner-occupiers' Association. Ideally the apartment owners add money to this fund on a monthly basis.

4.5 Need for advice and information

In the last two years a little more than half of the owner-occupiers have had some support or advice with the maintenance of their dwelling. From those who have had support or searched for advice and information roughly 40% to 50% needed more information on:

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- How the repairs could be carried out.
- How a reliable builder/constructor could be found.
- How to determine the costs of the repairs.

Remarkably often (in around two thirds of the cases) a construction or maintenance firm has been asked for advice and information. It is possible that these owner-occupiers have called in these constructors to carry out the job. In most other cases (around 40%) the owner-occupiers have used family/friends and/or the internet as a source of information. In less than 5% the local authorities have been asked for information and advice.

Asked for the need of support and advice in the near future a little less than 50% of the owner-occupiers say they (probably) need information and advice. This is roughly the same percentage as in the last 2 years. The determination of costs and finding a building or construction firm are here also the highest scoring subjects (see figure 8).

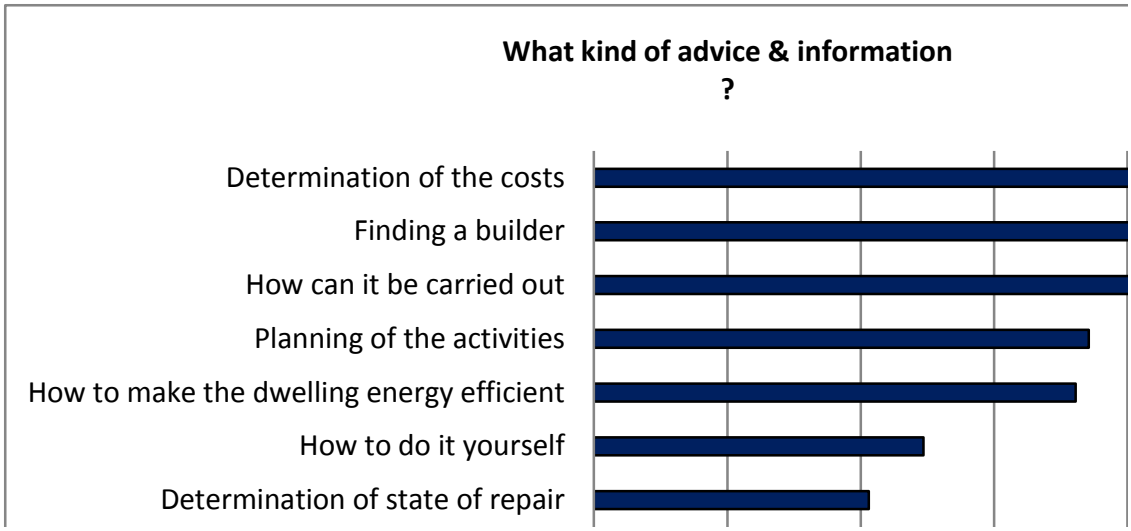

Figure 8. On what subjects advice and support is needed in the future?

The internet and construction firms are named by some two thirds of the owners as the source they would like to get their information from (figure 8). Around 50% of the home-owners will ask their family and friends for help. A quarter of the owners mention the local authority as the place they would like to go for information and support. Compared with what they actually have done in the recent past this percentage is remarkably high

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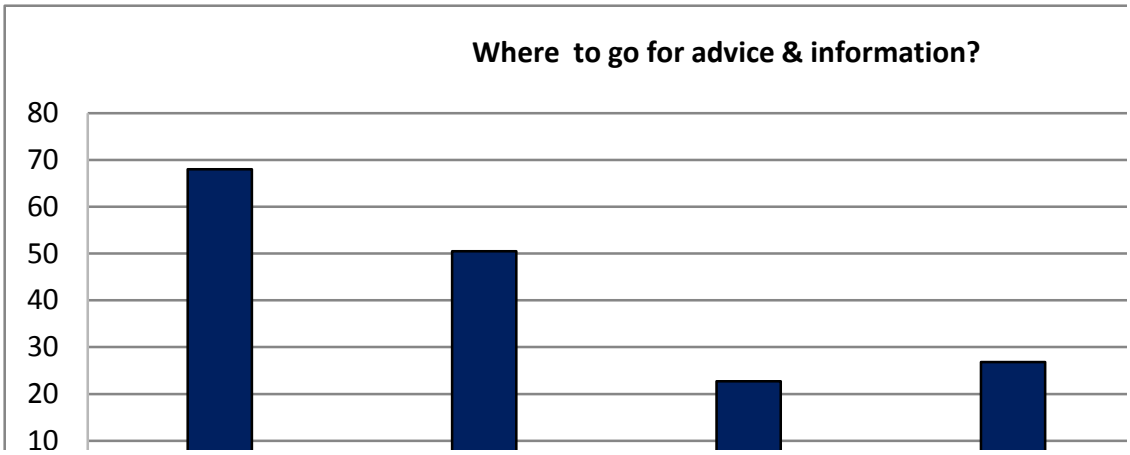

Figure 9: Where to get advice and information?

5 Conclusion

The last decades the owner-occupied stock has undergone a notable growth. From the 1980's on owner-occupation grew from some 40% up to 60% at present. The private rental sector declined from 21% to 9% at present. The growth of the owner-occupied sector can be explained by a substantial growth through new construction and by the selling out of private and social rented dwellings. The national government has made propositions to sell out large numbers of social rented dwellings in the near future. A further growth of the owner-occupied sector can be expected.
The local differences of the owner-occupied sector (in terms of size, age and housing type) are vast. In the larger municipal areas the relative importance the owner-occupied sector is far lower than the Dutch average. In these larger municipalities multifamily housing also has a larger relative significance.
Although the owner-occupied stock is still young, the ageing process is continuing rapidly. Relatively few owner-occupied dwellings have been built the last decade. When existing social rented dwellings are going to be sold out in vast numbers this ageing process will be accelerated. As a relative large part of social rented dwellings is located in multifamily housing, this will also influence the characteristics of the owner-occupied sector. At this moment more than 85% of owner occupiers live in single family houses.

The average Dutch home-owner is quite satisfied with his dwelling. The vast majority of owner-occupiers award their dwelling with satisfactory up to excellent marks. This applies as well to state of repair of the exterior and interior of the dwelling, the ease of use and comfort of the dwelling as the living conditions (residential area). This appraisal is based on the owners own opinion. The actual situation (especially with regard to the state of repair) could be different.
Owner-occupiers are quite active maintaining their dwellings. Only a small fraction of the owner-occupiers indicate that although (major) repairs or maintenance activities were necessary, nothing has been done. The lion share of owner-occupiers seems to maintain their dwellings in an adequate way. The most efforts are aimed at the exterior of the dwelling (especially exterior paint- and woodwork). A lot of work is also done inside the house (repainting, repapering and retiling and improvements of toilets,

bathrooms and kitchens). Installation and insulation jobs occur relatively the least. In most cases the central heating boiler is being replaced.
The most important reason to carry out maintenance work (and this applies to all three repair categories that have been distinguished) is because the building component was worn-out or had broken down. Other important reasons to repair the exterior of the dwelling is prolonging its lifespan and increasing its value. Work inside the dwelling is further predominantly done to increase ease of use and comfort. Reduction of energy use is an important additional reason for carrying out installation and insulation work.
On average a Dutch home-owner spends almost € 4,800 annually to maintain, repair and improve his dwelling. Compared with the average value of an owner-occupied dwelling (€ 263.000) this is quite a substantial expenditure.

In general owner-occupiers seem perfectly able to maintain their properties in an adequate manner without any help. Via communication instruments and partly (if available) subsidy and financial instruments some of these owners can be guided and stimulated.
The overall quality condition of the owner-occupied stock is as such not a convincing reason for the introduction of generic instruments and incentives. Nonetheless there are some 'problem' segments that may need attention from authorities. For these segments special dedicated instruments for quality improvement in the owner –occupied sector could be advocated and already have been developed.
With respect of maintenance backlogs a worrying situation can be identified in some parts of pre-war (single-family) dwellings in smaller municipalities and in multifamily houses (built before 1945 and between 1945-1970) which predominantly are located in some urban areas of larger municipalities. Current (communicative and financial) instruments are now being analysed in case study research. This could lead to a further sharpening and adaption of these instruments. It could also be wise to back these instruments up with some regulatory force. Local authorities have the possibility to intervene in non-functioning Owner-Occupiers' Associations with major repair backlogs. It is feasible that this is broadened to other parts of the owner-occupied stock. This should be done under the express conditions that this regulatory intervention is confined to a certain space (specific area) and time period. Besides that intervention should be based on a firm democratic foundation based on a univocal cost-benefit analysis.

Main goal for the future is – under the principle that prevention is better than cure - to take care that that current quality backlogs do not spread further. A final aspect to consider here is that social rented dwellings should not be sold out without conditions Demands should be made on minimum quality levels before sale, the selling process and (the organization of) maintenance after sale.

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REVIEW AND ANALYSIS OF THE RESIDENTIAL BUILDING CERTIFICATION PROCESS IN SOUTH EAST QUEENSLAND

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ABSTRACT

In Australia, building certifiers ensure that building projects are constructed to required standards as specified in the building regulations. The certification process involves the assessment of the building and design documentation for compliance before the building work commences and then verifies that the work is carried out in accordance with the approved plans. In Queensland building certifiers are accredited and licensed by the Building Services Authority (BSA). Inspections for building work can also be carried out by a local council building certifier, but many councils now permit owners and builders to employ their own private certifiers. The building certifier inspects the project during progress of the work and can give directions, issue permits, notices and orders as required ensuring compliance. Owners and builders employ building certifiers, often as private certifiers to give their advice on their proposed projects. The four stages of approval stages of building certification are described. A sample of the inspection and certification records of 109 houses in South-East Queensland and analyses their progress through each of the stages. The incidence of minor faults and failures are examined together with requests for further information. Trends in these incidents are enumerated, described and analysed with a view to improving the process.

Keywords: building certification, faults, residential buildings

INTRODUCTION

The private building certification system was established in 1998 in Queensland following the lead of the state of Victoria, which established the system in the Building Act 1993 (State Government of Victoria, 1993). With nearly 15 years of experience of private building certification it is now well established as part of the building approvals environment in Queensland. The task previously carried out by local government building departments is now the responsibility of private certifiers.

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Building certifiers ensure that building projects are constructed to required standards as specified in the building regulations. The certification process involves the assessment of the building and design documentation for compliance before the building work commences and then verifies that the work is carried out in accordance with the approved plans. The building certifier inspects the project during progress of the work and can give directions, issue permits, notices and orders as required ensuring compliance. Owners and builders employ building certifiers, often as private certifiers to give their advice on their proposed projects. If regulations are breached building certifiers may issue notices and orders through the local council and when required they may prepare reports and provide evidence as expert witnesses in court cases. The aim of this preliminary study was to quantify the number and extent of the referrals and failures in the building certification process and to ascertain whether the private certification was working satisfactorily.

THE BUILDING APPROVALS PROCESS

Discussions before the *approvals stage* are known as the consultation stage and are aimed towards compliance with relevant legislation, local authority requirements and any other extraneous issues that should be addressed by the applicant before formally lodging the works. During these discussions the building certifier will try to focus on the client's questions and endeavour to answer all the questions as accurately as possible. Accuracy of the information given to the client at this stage is of utmost importance and is essential as this will allow for better progress with future processes once a formal applicant is lodged with the office. The building approvals process is summarised in a flowchart in Figure 1.

After the final administration checks have been completed (Consultation and Review in Figure 1) the actual building approval can be finally issued. Once issued the document explains to the applicant all the specific and standard conditions the certifier has applied to the application to highlight what the construction will need to comply with – these conditions could be viewed as "guidelines" for the applicant to keep be aware of during the life of the building approval.

For instance a standard slab on ground, brick veneer, timber or steel framed dwelling has 5 inspections that are required by the Standard Building Regulation 1993 (Government of Queensland, 1993). These stages are:

1. Site – inspection of the applicable site to ascertain everything matches the approved plans and that no services may be located in a different position to the council plans. A land surveyor may have also positioned the dwelling's footprint to ascertain setback distances at this stage.

2. Footing – this is an inspection of the excavations, which will support the dwelling. Sometimes this inspection includes checking reinforcement. This inspection occurs before concrete is poured to confirm sizes/depths of footings and reinforcement spacing and size.

3. Slab – similar to the footing inspection stage, the slab stage is done after the footings have been poured. Aspects of this stage include checking the reinforcement, plastic membrane installation, compaction of soil/sand and also any lagging to horizontal plumbing penetrations.

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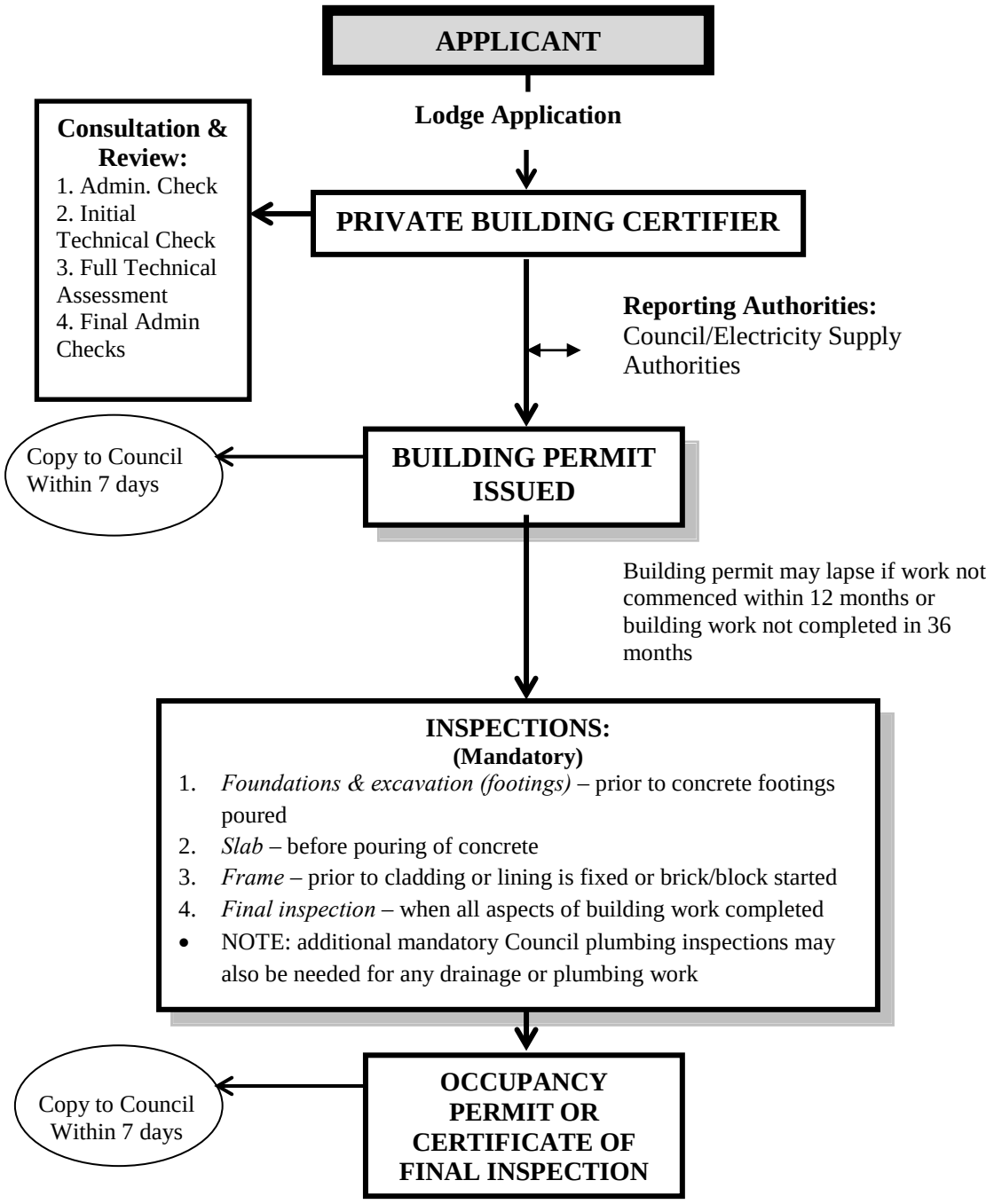
4. Frame – the framework will either be assessed against the Standards Australia (2010) *Australian Standard AS1684.2-2010 – Residential Timber Framed Construction* or an engineer's design for timber and or steel. General inspection items are tie-downs, bracing, structural member sizes and also truss installation.

Figure 1 Building Permit Process and Inspection Stages



5. Final – the last of the required inspection stages will have differing aspects to inspect depending on the design of the dwelling. Items that are usually inspected closely are termite protection, weather and vermin proofing, smoke alarms, stairs/balustrading, wet areas and even site drainage.

Lastly, the building approval decision notice contains advice for all the applicants on their appeal rights against the building certifier's conditions contained within the decision notice. The applicant has 20 business days to lodge an appeal with the Building and Development Dispute Resolution Committee, who notify the relevant certifier if this occurs. If the applicant fails to lodge an appeal with the Committee within 20 business days the conditions of the decision notice are deemed accepted.

METHODOLOGY

Access to a private certifier's inspection data base was given to the authors and 109 houses were randomly selected from the data base based on the year 2010. The first 109 new houses were selected from the list of all houses. All the houses were built in south-east Queensland from the Gold Coast and the Brisbane region. This was the area covered by the private certifier. The full range of inspections was conducted to completion. The records of each house inspection at each of the stages were examined with the detailed notes of each inspection reviewed and analysed. The inspector's notes were often extensive and detailed and the authors condensed these down into the main causes of problems in approval for that stage. The localities, builders (or owners), values of work were as random as well as the selection of houses.

Inspections reviewed were 4 in total; footings, slab, frame and final.

Incidents recorded and tagged in database were summarised and coded as follows:

a) RFI = *Requests for Information* from the builder before a final decision is made.

b) P = *Pass* (the inspection confirms the work is in accordance with code and other documents.

c) M = *Minor problem*. Approval not given for minor infringement to documents and/or code.

d) F = *Fail*. Inspection shows work cannot be approved unless rectification work carried out.

DATA ANALYSIS

Requests for Information (RFI)

Of the 109 buildings in total, 55 buildings (50.5%) required a RFI at some stage in the approvals process. RFIs are related to minor faults and fails where more information is needed, with most occurring at the final approvals stage.

Minor Faults

A summary of the total number of the minor faults at each stage is shown in Table 1. The final two stages, Frame (3) and Final Inspection generated the largest number of minor faults. Some houses had multiple incidents of minor faults.

Table 1 Minor Faults at Each Inspection Stage

STAGE	1. Footing	2. Slab	3. Frame	4. Final
No. Incidents	4	3	49	56
% Total Houses Affected	3.70	2.80	45.00	51.40

Footings

Only 4 recorded incidents on footings inspections were noted. These were in the minor (m) category and these only represent 3.7% of the total sample of 109.

Slab

A total of 3 minor incidents were recorded over the whole sample. This is 2.8% of the total sample.

Frame

49 minor incidents were recorded. This represents 45.0% of the total number of houses inspected. In addition, there were 3 instances (2.8%) of a failed inspections (f/re=p or m) with a resubmission (re). The results show that 2 of the 3 instances resulted in a pass (p) and the remaining one still had a minor fault (m). This one eventually passed.

Final

The results show that 89 of the sampled houses (51.4%) had minor faults when the inspection took place. Again, 3 houses (2.8%) had initial failed inspections (f/re=p or m) and required a resubmission. One of the resubmissions passed and the remaining two had minor faults needing rectification, but they eventually passed.

Overall

All 109 houses passed all their inspections.

REQUESTS FOR INFORMATION (RFI)

As noted earlier around half of the 109 buildings required a RFI at some stage in the approvals process. These RFIs consisted of the following types of information:

(a) Missing builders insurance and portable long service leave payment.

(b) Building's design does not comply with BCA or Australian Standards.

(c) Missing Engineering plans for all structural members including Engineer's Certification.

(d) Further Development Applications required – planning approvals, plumbing approvals, landscape approvals and operational works approvals.

(e) Various miscellaneous not catgeorised

CAUSES OF MINOR FAULTS

Analysis of the inspection records show that the major causes of problems at each stage can be summarised.

Footings

Of the 3 instances of minor faults the causes were as follows:

(a) The builder built within 1.5m of sewer line.

(b) Concretor had not installed second layer of mesh as per engineer design.

(c) Sediment barrier required to rear of property for stormwater control.

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Slab

The 3 instances of minor faults are:

(a) Rain had filled footings; no termite barrier installed; missing formwork.

(b) Provide missing bar chairs for support & concrete cover as per approved engineers design (see photograph 1 below).

(c) Missing reinforcement at corners of slab & "Z bars" required as per engineers design

Frame

Of the 49 instances of minor faults the major causes can be categorised as follows:

Most of the framing issues all have a common theme for the minor issues and these are highlighted below. Some houses also have multiple items and these have been documented in the inspection reports for each house with minor faults:

a) Incorrect installation of bracing or missing bracing (90% of the houses with minor faults).

b) Tie down not adequate or incorrectly installed for the site (90%).

c) Trusses damaged or incorrectly installed (not as per truss layout(20%)

d) Incorrect timber sizes and incorrect stress grade for intended purpose(15%)

e) Miscellaneous items – smaller issues eg. No internal wall brackets or poor workmanship (<10%)

Final

Of the 89 instances of minor faults the major causes categories were as follows:

(a) Healthy and Safety issues - missing smoke alarms, missing balustrading (90%)

(b) Issues with installation or absence of the termite barrier installation (90%)

(c) Wet Areas were not complete (30%)

(d) Missing termite stickers – Queensland requires one in meter box and one under kitchen sink.(30%)

(e) Site drainage – incorrect fall away from the dwelling. This is often due to the landscaping being done at a later date(20%).

(f) Miscellaneous (<10%)

CAUSES OF FAILED INSPECTIONS

Analysis of the inspection records show that 6 properties failed inspections at the frame and final stages. These are now described for each stage.

Frame

Of the 3 instances of failed inspections the causes were as follows:

(a) Steel frame - missing screws at truss connections, missing screws at truss tie down points, roofing bracing to be correctly installed as per truss layout, tie down rods not tensioned and trusses to be installed as per engineer's detail.

(b) Diagonal bracing members not fixed as per approved plans to wall framing, rafters require tie down as per approved tie down plans and lintel fixing to wall frame not readily apparent, please identify method of fixing.

(c) Steel frame not installed as per manufacturer's design, "K" braces require bolts to corners of brace as per manufacturer's detail. The jack truss/truncated truss connection requires two screws as per truss layout, internal load bearing walls require tie down with brackets as detailed in manufacturer's manual.

Two of the instances involve missing screws and bolts, which points to a lack of attention to detail and possibly a lapse in supervision and quality control in these two areas. The third fault was lack of attention to the approved plans and not providing the required tie down requirements for the truss and fixing to the walls. Whilst none of these faults are serious they are sufficient for the inspector to not give approval.

Final

The 3 instances of failed inspections were:

(a) Seal all articulation joints. Ground levels are required to slope away from the dwelling, stormwater field gullies need to be connected to stormwater system. Patio not installed as per approved plans including stormwater system. Steps externally should not to exceed 190mm as per BCA volume 2. Stormwater must be connected to kerb discharge point and weep holes near gas cylinders should be unblocked.

(b) Dwelling located in a bushfire prone area – dwelling construction does not comply with AS3959-2009 Construction of Buildings in Bushfire Prone Areas for Bushfire Attack Level 12.5.

(c) No access to internal parts of dwelling and owner un-contactable.

CONCLUSION

Incidents and problems in certification come from two major sources. The number of Requests for Information (RFIs) and minor faults or problems are in most cases easily fixed and do not cause any major delay in the approvals system. The number of RFIs affected around 50% of the surveyed houses in the 109 sample. Their cause is mainly due to lack of information or missing paperwork. The incidence of minor faults is more pervasive. They rarely occur during the first 2 inspection stages (footings and slab) and they are more prevalent during the final 2 stages of inspection and approval (frame and final).

Explanations for this can be suggested from the experience of the authorS. The first two stages are crucial for the builder and for the engineering requirements and they must be correct. Failure to ensure full compliance with errors of detail, material or problems of construction can be expensive and time consuming. For instance, if the footings or slab does not comply with the drawings, specification or the Code it will probably entail removal of concrete, reinforcement and additional excavations. The

footings or slab may have to be removed and a new one complying would have to be laid.

The next stage, frame, consists of more materials, on site operations and activities providing the possibility of non-compliance. This is borne out by the statistics from the 109 houses. 49 Houses or 45% of the total sample have minor defects to be rectified before approval. These defects can often be rectified quite quickly and easily and their consequences are not as great as for the footings and slab.

The final stage has created the most minor defects requiring action. 56 of the 109 houses have defects at this stage and the reasons for the number is due to the same reasons as the previous frame stage. That is, there are more activities, work sections and trades involved in this final stage offering greater possibility of error. Again, the errors can quickly and at low cost and time be rectified.

The serious problem of failed inspections is not extensive. In fact, none occurred during the first two stages and three rejected approvals were identified at each of the framing and final stages. Three rejections represents 2.8% of the full sample of 109 houses and is not excessive or a cause for concern. It confirms the inspection process and the pre-inspection is working relatively well. If this rejection rate was 5% or above, then a review may be necessary and some criticism could be levelled at the inspection process. However, this is not the case, but the need for vigilance and striving for higher standards must continue and no short cuts with demands for self regulation should be accepted by the authorities. The building control and certification system is working well and the regulations, codes and trained personnel are maintaining high standards of construction and safety.

This limited analysis supports the view that private building certification appears to be working effectively. Analysis of the data shows inspections are carried out rigorously and that even minor infringements are being noted. An extended analysis of the inspection data covering more than 109 houses and involving more than one private certifier could evaluate and compare the results in this study with a more extensive analysis.

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Roadmap of Regulating Zero-energy Buildings in Finland

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Abstract:
Improving energy efficiency in buildings is of high level importance in EU. Measures that reduce energy consumption and thus also GHG-emissions are based on cost-optimacy. Directive on energy performance of buildings casts requirements for both new and existing buildings and therefore will have wide impact in the society as a whole. Implementation of the directive has been made in two stages. Regulation of new buildings involves the shift of treating the building as an entity when calculating the energy performance. Existing buildings – implementation currently under process - require a flexible but still accurate threshold for the purposes of applying energy requirements in renovations. Also the target of reaching nearly zero-energy buildings is soon at hand. Achieving of these improvements described in the directive require active measures in every member state. Finnish legislator has to face the climate conditions, heterogeneous group of building owners, administrative culture and Constitutional requirements of which the latter, more than others, seems to cause difficulties. However, ways to comply with the Constitution can be found. Overall, the Finnish legislation is obligated to take into consideration technical, functional and economic feasibility as the directive obligates.

Keywords:
Building regulation, energy efficiency, existing buildings, new buildings, zero-energy buildings.

1 Introduction

Finland as a member of EU shares the ambitious goal in climate and energy policy. New measures for increased energy efficiency are proposed by the European Commission which includes also obligations for energy performance of buildings.[1] Common target in EU, set out in the directive on energy performance of buildings, is to achieve nearly zero energy buildings in the year 2020. Improving the energy performance of buildings is a cost-effective way of fighting against climate change and improving energy security.[2]

[1] Energy Roadmap 2050, 2011, p. 9.
[2] McKinsey&Co 2012, p. 8.

The implementation of EU legislation poses huge challenges to Nordic countries like Finland since buildings constitute some 32% of GHG emissions and 38% of energy consumption in Finland[3]. These challenges affect not only new buildings but first and foremost existing buildings. Keeping in mind the fact that buildings constitute a huge share of national wealth, it is not indifferent how buildings are maintained. To achieve healthy and energy efficient buildings a high class engineering skills among rational legislation are required.

This work will introduce the Finnish way of implementation of the current energy efficiency legislation concerning buildings. The objective of this paper is to examine the current and forthcoming legislation and to point out some of the challenges in this area. Juridical focus highlights the constitutional requirements for the forthcoming legislation. The topic is highly current since the implementation is partly under process at the moment. There are recent studies and articles that deal with energy efficiency in building sector but there aren´t any with mainly legal perspective.

2 Conditions for action

Due to Finland´s somewhat Nordic geographical position and being the northernmost EU member, climate plays a crucial role in building sector. Finland´s climate (latitude 60-70°N) is characterized by great variation. Thermal winter is relatively long but in the summer it can get fairly warm. Climate change will significantly change the seasons but still cold winters will occur[4]. Recent studies implicate for example that rain and snowfall will rise.

In Finland 62% of energy related for housing is needed for heating rooms and domestic hot water.[5] Hence in Finland thermal insulation has played a crucial role in energy efficiency. Before the new directive on energy performance of buildings and the E-number, energy efficiency of a building were indicated with a U-symbol reflecting the heat loss of structural parts (e.g. wall, window, ceiling etc.). Concentrating to minimize the heat loss it was quite simple just to thicken the insulation layer. Now when calculating the E-number, other elements of energy efficiency of a building will be highlighted so it increases flexibility but at the same time sets much higher requirements. The latest tightening nationally in energy efficiency regulation for new buildings was only two years ago. Then the improvement was approximately 30 %, and now due to EU-based regulation 20 % tightening will be presented.

3 Energy Performance of Buildings

EU adopted on 19th of May 2010 a directive on the Energy Performance of Buildings (EPBD) (2010/31/EU). Under this directive member states must: 1) establish and apply minimum energy performance requirements for new and existing buildings; 2) ensure the certification of building energy performance; 3) require the regular inspection of boilers and air conditioning systems in buildings and 4) ensure that by 2021 all new buildings are so-called 'nearly zero-energy buildings'.

[3] Statistics Finland 2010.
[4] Towards a low carbon Finland 2009, p. 124.
[5] Energy visions 2050, 2009.

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The EPBD is linked to several policies with high status in EU and has different objectives as well. Policies related to the EPBD are the following: fighting against climate change, improving energy security, creating job opportunities, promoting technological developments and also increasing the use of energy from renewable sources. One important objective of this directive is to reduce the large differences between member states´ results in this sector. Measures introduced in the EPBD are estimated to reduce final energy consumption with 5-6 % and to lead reduction of 4-5 % in carbon dioxide emissions by 2020[6].

3.1 Common requirements in the Energy Performance of Buildings Directive

The EPBD lays down frames in which the measures to improve energy efficiency has to be taken. These frames are common to new and existing buildings. In terms of practicality, when setting requirements, member states may differentiate between new and existing buildings and between different categories of buildings. Measures take into account climatic and local conditions as well as indoor climate environment and cost-effectiveness. A cost-optimal balance between the investments involved and the energy costs saved throughout the lifecycle of the building is a key factor when introducing these above mentioned measures. According to article 4 in the EPBD a member state shall not be required to set minimum energy performance requirements which are not cost-effective over the estimated economic lifecycle. The EPBD obligates member states to review the requirements at regular intervals of maximum five years.

A member state has a right not to apply the requirements to buildings with a little significance to energy efficiency i.e. member states may differentiate between different categories of buildings. This group includes: officially protected buildings and buildings with special architectural or historical merit; buildings used as places of worship and for religious activities; temporary buildings with a time of use of two years or less, industrial sites, workshops and certain types of non-residential agricultural buildings; residential buildings which are used or intended to be used for either less than four months of the year or, alternatively, for a limited annual time of use and with an expected energy consumption of less than 25 % of what would be the result of all-year use and stand-alone buildings with a total useful floor area of less than 50 m2. This easement leaves for example normal summer cottages out of the scope of the EPBD if a member state decides so.

Under the EPBD a member state has a right to set minimum requirements which are more energy efficient than cost-optimal energy efficiency levels. This means that the EPBD has a nature of minimum harmonization. However the Commission controls discrepancies between member states. The Commission lays down a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements and then member states are obligated to use this framework to compare the results which they have adopted. If there is a gap between cost-optimal and the actual national standard, exceeding 15%, member states have to justify the difference or plan appropriate steps to reduce the discrepancy. Furthermore these measures mustn´t affect other requirements concerning buildings such as accessibility, safety and the intended use of the building.

[6] Ministry of the Environment in Finland ; European Commission, presentation, p. 5.

The method of calculating the energy performance of buildings is also harmonized in the directive. The methodology for calculating energy performance is based not only on the season in which heating is required, but has to cover the annual energy performance of a building. Moreover, several factors are included to the calculation method, such as thermal characteristics, heating and air-conditioning installations, application of energy from renewable sources, passive heating and cooling elements, shading, indoor air-quality, adequate natural light and design of the building.

3.2 New Buildings

Taking into account that new buildings constitute annually only a very small amount of the total building mass in EU, and also in Finland, and the fact that the life cycle of buildings is usually at least 50 years; the objectives in energy efficiency have to be future-orientated. In the year 2050 half of the buildings are constructed after 2012[7].

EPBD casts obligations for new buildings. According to article 6 in the EPBD all new buildings have to meet the minimum energy performance requirements set out more detailed in article 4. What´s important in article 6 is the requirement to consider and to take into account, if available, the technical, environmental and economic feasibility of high efficiency alternative systems before construction starts. These systems include for example decentralized energy supply systems based on energy from renewable sources, cogeneration, district or block heating or cooling and heat pumps. This requirement broadens the scope of the EPBD from buildings to surrounding built environment and energy systems.

Article 9 sets out that by 31 December 2020 all new buildings are nearly zero-energy buildings and after 31 December 2018 new buildings occupied and owned by public authorities are also nearly zero-energy buildings. This latter requirement points out the principle that public sector leads by an example, which is highlighted by the European Commission[8].

In Finland the EPBD concerning new buildings is implemented mainly through the National Building Code of Finland (NBCF). Even though the EPBD has some detailed regulations there is still a lot for national legislator to do. The NBCF contains regulations and guidelines that complement the legislation in the Land Use and Building Act (132/1999, LUBA), which is the main legislative instrument controlling land use, spatial planning and construction in Finland. In the NBCF there is division to regulations and guidelines; the building regulations must be followed, but building guidelines are not obligatory, and other solutions may be used in construction as long as all the compulsory regulations are observed[9]. Recently the connection between the LUBA and the NBCF has been questioned in relation to the constitution of Finland. Problems related to this will presented later in this paper.

The regulation required in the EPBD concerning new buildings will enter into force in Finland July 1st 2012. The Ministry of Environment gave the regulations March 31st 2011 in the National Building Code of Finland in sector D3. The new D3 reflects the Finnish way of implementing ambitious objectives set out by European Union and at the

[7] Ympäristöministeriön raportteja 4/2012, p. 74.
[8] see for example, EPBD page 4.
[9] Ekroos 2005, p. 58-59.

same time is a step forward in the road to almost zero-energy buildings in Finland. D3 has major changes to the previous regulation – it introduces the concept of "total energy consumption of a building" and the "primary energy factors" and also the concept of "standard use of a type of building".

D3 obligates to calculate the total energy consumption of a building according to specific information provided in the same regulation and in its´ annexes. The total energy consumption of a building is described as "E-number". The maximum E-number varies according to different categories of usage of the building. There are 9 different categories in which the buildings are divided (see table 1).

category 1	single-family houses (≥ 50 m²)	204-130 kWh/m² in a year
	log houses (≥ 50 m²)	229-155 kWh/m² in a year
	row houses and chain of houses	150 kWh/m² in a year
category 2	apartment buildings	130 kWh/m² in a year
category 3	office buildings	170 kWh/m² in a year
category 4	commercial buildings	240 kWh/m² in a year
category 5	accommodation buildings	240 kWh/m² in a year
category 6	educational buildings and kindergartens	170 kWh/m² in a year
category 7	sports halls (excluding ice- and swimming halls)	170 kWh/m² in a year
category 8	hospitals	450 kWh/m² in a year
category 9	other buildings and fixed-term buildings	no value, but calculated

table 1: The E-number mustn´t exceed certain values (kWh/m²/year).

For the category 9 there is no maximum E-number but the calculation needs to be done. Finland, as national feature, has its own value for log houses. Furthermore the value varies in case of single family houses and log houses according to the warmed net area (m²). The fundament with the calculation of the E-number is that it gives only the objective but the means achieving it are in the hands of architects and other designers. This will predictably increase also the possibilities to carry out more interesting architecture.

When calculating the E-number also the primary energy factors have to take into account. Factors reflect the use of natural resources in the production of energy. Primary energy types with different factors are following: electricity 1,7; district heating 0,7; district cooling 0,4; fossil fuels 1,0; renewable fuels 0,5. These factors encourage the builders to the use of renewable energy and generally environmentally friendlier types of energy. From the constitutional legal point of view these energy factors are at least questionable, because they have substantial significance, but they are not based on any Act, which is requirement of section 80 of the Constitution.

All new buildings require a building permit according to the LUBA section 125. The calculation of the E-number is presented in connection with building permit application. The building permit mustn't be granted if the E-number requirements aren´t met.

3.3 Existing Buildings

There is a great potential in existing buildings concerning energy efficiency. Firstly, existing buildings override new buildings in numbers; secondly, the current condition considering energy performance in the existing buildings is often quite poor in comparison with the new ones. In Finland 64% of the buildings (gross floor area) is built in the 1960-2000[10]. However the building stock in Finland is relatively young in contrast to most of Europe. On the other hand, improving the energy efficiency of existing buildings is more expensive and technically more difficult in comparison with new buildings.

Before the EPBD, energy efficiency regulation in Finland affected mainly only new buildings. According to the NBCF the regulations are applicable to renovations and alterations works only insofar as the type and extent of the measure and a possible change in use of the building require. After the Ministry of the Environment gets the implementation process through, the NBCF will affect the existing buildings accordingly to article 7 of the EPBD.

When buildings undergo major renovation, the energy performance of the building or the renovated part thereof is upgraded in order to meet minimum energy performance requirements set in accordance with article 4 of the EPBD. Also, when a building element, such as roof or wall, is retrofitted or replaced, the energy performance of the building element has to meet minimum energy performance requirements. Precondition for both cases – building or building element – is that the upgrade has to be technically, functionally and economically feasible. To fit in the scope of article 7, the building elements have to form part of the building envelope and have a significant impact on the energy performance of the building. Whether the conditions are met needs to be considered in connection with the building permit.

A "major renovation" is clarified in the article 2 of the EPBD; the total cost of the renovation relating to the building envelope or the technical building systems is higher than 25 % of the value of the building, excluding the value of the land upon which the building is situated, or, more than 25 % of the surface of the building envelope undergoes renovation. Member states may choose to apply either one of the definitions to act as a threshold for building permit application.

Also in the case of existing buildings, the alternative systems, as referred in article 6, are required to take into account before the renovation starts, if available.

Article 8 of the EPBD casts requirements for both existing and new buildings. It deals with technical building systems and obligates to cover at least heating and hot water systems, air-conditioning and large ventilation systems or a combination of such systems. According to article 8 for the purpose of optimizing the energy use of technical building systems, member states shall set system requirements in respect of the overall energy performance, the proper installation, and the appropriate dimensioning, adjustment and control of the technical building systems which are installed in existing

[10] Rakennusperintö 2011.

or new buildings. Here as well the technical, economical and functional feasibility has to be taken into consideration.

In Finland the legislative process concerning the implementation of the EPBD for the renovation of existing buildings is currently (May 28th 2012) under process. The Ministry of the Environment is in charge in the process. Timetable for the new acts, enactments and other regulations concerning the issue is quite strict. They need be published at latest of July 9th 2012 and entered into force January 1st 2013 concerning buildings occupied and owned by public authorities and for other buildings July 9th 2013. At the moment it is quite obvious that Finland can´t follow the schedule, since the proposal for the new regulation hasn´t been given out yet. After the proposal different parties interested shall give their opinion on the matter and then the Ministry will start drafting the final version. Changes to the LUBA are also required, so the governments' bill has to be drafted as well. Naturally the voting of the bill goes to the national parliament. According to official in charge of the implementation process, some of the details still lack of political consensus[11].

The EPBD leaves member states some margins to adjust the requirements to national conditions.[12] The Finnish tradition of flexibility in the energy efficiency requirements for renovations can still continue in some scale. The objective in the upcoming regulations is to apply the energy efficiency requirements if the need for renovation emerges. The new regulations, naturally, won´t launch renovations just by themselves; the decision whether a building is in a need of a renovation is in the hands of the owners of the buildings. After the decision to launch a renovation has been made, then the question of applying the requirements is relevant.

At this stage of the preparation some challenges, distinctively other than juridical ones, can be pointed out. Generally speaking the building industry is worried about the amount of highly enough skilled people in the designing and in the building sector. The most common worry is related to the question how to assure that new or renovated buildings will stand out technically and how the construction products will be developed and tested to meet the standards. Sufficient resources and level of professionalism in building control is also a question that has risen.

4 Juridical Challenges

Road of regulating energy performance of buildings faces also juridical challenges. One major question is related to the Constitution of Finland (11.6.1999/731). Section 80 in the Constitution deals with issuance of Decrees and delegation of legislative powers. According to the Constitution: "The President of the Republic, the Government and a Ministry may issue Decrees on the basis of authorization given to them in this Constitution or in another Act. However, the principles governing the rights and obligations of private individuals and the other matters that under this Constitution are of a legislative nature shall be governed by Acts." Furthermore the section 13 in the LUBA gives the competent ministry (the ministry of the environment) powers to issue technical and corresponding general regulations and instructions supplementing this Act, which are published in the Finnish Building Code. The question is: do the new

[11] Locus 2012, p. 36.
[12] Hollo 2011, p. 360.

requirements have a nature of technical regulations or do they affect the rights and obligations of private individuals? Chancellor of Justice in Finland has recently given his opinion on this matter. The message in his statement is quite clear, indicating the current situation to be in violation with the section 80 of the Constitution.[13] Thus, in order to rectify the legislative problem, the basis or principles of calculating the E-number needs to be given in the LUBA. Furthermore, the power of issuing decrees also needs to be described more definite in the LUBA and should be appointed apparently to the Government, instead of the Ministry of the Environment.[14]

Secondly, Chancellor of Justice also found problematic having the instructions with non-binding status situated in the NBCF at the same time with the regulations with binding status. Keeping this in mind, the implementation of the EPBD concerning existing buildings requires more profound legislative actions than just altering the NBCF.

Third challenge deals with taking the definition of "major renovation" into practice. The EPBD allows two kinds of interpretations; 25 % of the value or 25 % of the surface. The definition concerning the value is quite artificial and it could lead to different interpretations depending where the building is situated and what is the buildings value. On the other hand if the definition follows the 25 % surface condition, builders might have a temptation to make projects in smaller pieces and thus avoid the energy efficiency objectives. This is something that is needed to take into consideration when implementing the directive. The most appropriate way of evaluating the definition would be in connection with building permit or other permit.

5 Conclusions

Energy efficiency requirements in building sector concerns all member states. Finland has to adopt new legislation according to the objectives set out in the EPBD. From juridical point of view it is a challenge to create such legislation that would comply with constitutional requirement, constantly developing society, technology and with the Nordic climate. The constitutional question is highlighted in a situation like this when the current legislation is older than Constitutional requirements and new regulations have to be adopted.

Situation with new buildings is quite clear in the NBCF. Major challenges come along with the implementation of the EPBD concerning existing building. Defining the threshold of applying energy efficiency requirements for renovations is the most crucial factor in the forthcoming legislation. This will have huge impact on those who make decisions on how to maintain their real estate properties or to investors as well. The ideal legislation has to answer often contradictory virtues such as predictability, accuracy and flexibility.

[13] OKV/454/1/2011, p. 4; see also Ekroos 2011, p. 9-10 and 14.
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Sustainable Building Envelope Design: A Thermal, Energy and Life Cycle Costs Analysis/Optimization

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Abstract:
Buildings play an important role in any society's urban development - socially, environmentally and economically. They affect the quality of life and productivity of their users. However, many designers overlook the social and environmental impact of their buildings and focus merely on minimizing capital costs while providing the minimal acceptable service. On the other hand, many global endeavors tend to encourage the adoption of sustainable/green concepts in buildings design. Thus, a research that provides framework for adopting green construction approaches in developing countries such as Egypt would be essential. An integrated framework to design building envelope systems (walls, windows and roof), focusing on importance of attaining thermal comfort and energy effeciency, without compromising costs, will be introduced. Following the framework principles, a model has been developed that functions through three main modules: (1) A Memory Module; (2) A Central Processing Unit (CPU) Module, and (3) A Control Unit Module. The model represents a comprehensive yet easy application tool for energy and costs trade-off analyses/optimization platforms. The developed model has been applied to a case study where many analyses were conducted. Finally, a simulation of possible building designs combinations was conducted to show the relationship between costs and sustainable indicators of different alternative designs.

Keywords:
Building thermal performance, Design optimization/simulation, Green buildings, Lifecycle cost, Sustainable design.

1 Introduction

In the context of global warming and its increased risks to the society, such as the rise in greenhouse gases emissions, resource depletion…..etc., it is extremely important to pay attention to the building's design in terms of sustainability. Using a sustainable design in buildings is a vital step towards energy and cost savings. However, Egypt is considered still limping in the field of energy savings or sustainable building designs. Till now, there is no established green rating system (Egyptian Green Building Council, 2012). Moreover, based on an Egyptian construction market survey, it has been assured that a worthy segment of professionals in the Egyptian private sector

neglects the use of sustainable building design approaches (Assad, 2011). This might have contributed to the huge growth of Egypt's residential electricity consumption to reach more than three times international and Arab-world averages for the period of 2002 to 2010 (Hussein, 2012). Meantime, many global efforts have been made to assist designers in applying green building designs. Simulation programs/tools such as: energy plus, DOE, ESP-r …etc., have been developed and used to assess the impact of design parameters on the building performance. However, they are perceived by most professionals as being complex and demanding since large amounts of information and detailed design, which is usually not available during first design stages, is required for their operation (McKay, 2007). Also, the iterative trial-and-error process of such tools is viewed by some professionals as being ineffective (Wang et al., 2005). On the other hand, since designers rarely consider only one criterion in the decision-making process, multi-objective optimization models have been proposed by many studies (Ginevieus et al., 2008; Kanagaraj and Mahalingam, 2011). Although multi criteria decision making provides a more integrating approach, it requires trade-offs between importance of different parameters by giving criteria weights that require great level of experience, accuracy and objectivity which might be difficult to find in some designers.

Due to the above, it is important to propose an integrated framework to promote the use of sustainable building design in Egypt. An easy comprehensive framework is recommended to be adopted for buildings envelope design. Moreover, a generic model is developed based on the framework to prove its applicability and comprehensiveness.

2 Proposed Framework for Optimum Sustainable Building Envelope Design

The proposed framework to reach an optimum sustainable building envelope design works through three main modules, as shown in Figure 1. These modules interact with each other dynamically to provide optimum green designs as will be illustrated.

1.1 The Memory Module

The first module is an organized memory that is subdivided to short term and long term. The long term memory stores information that could be used for different projects and designs. It can be categorized to five subsections. The first one includes basic construction materials and their associated technical properties such as: conductivity, U-value, shading coefficient and embodied energy. The second one stores cost related information which includes different materials costs and its lifetime (initial, maintenance, operation and replacement). It also includes general economic data as interest and inflation rates. The third and fourth subsections stores weather related data that depend on building location (city and country) and orientation. The information covers for each location the monthly average ambient temperature data, solar heat gain factors and the cooling load factors for each orientation. The last subsection in the long-term memory is related to energy data, such as energy costs associated to needed electricity loads. On the other hand, the short term memory includes three main categories which are: building design & preferences, indoor quality and lifetime analysis.

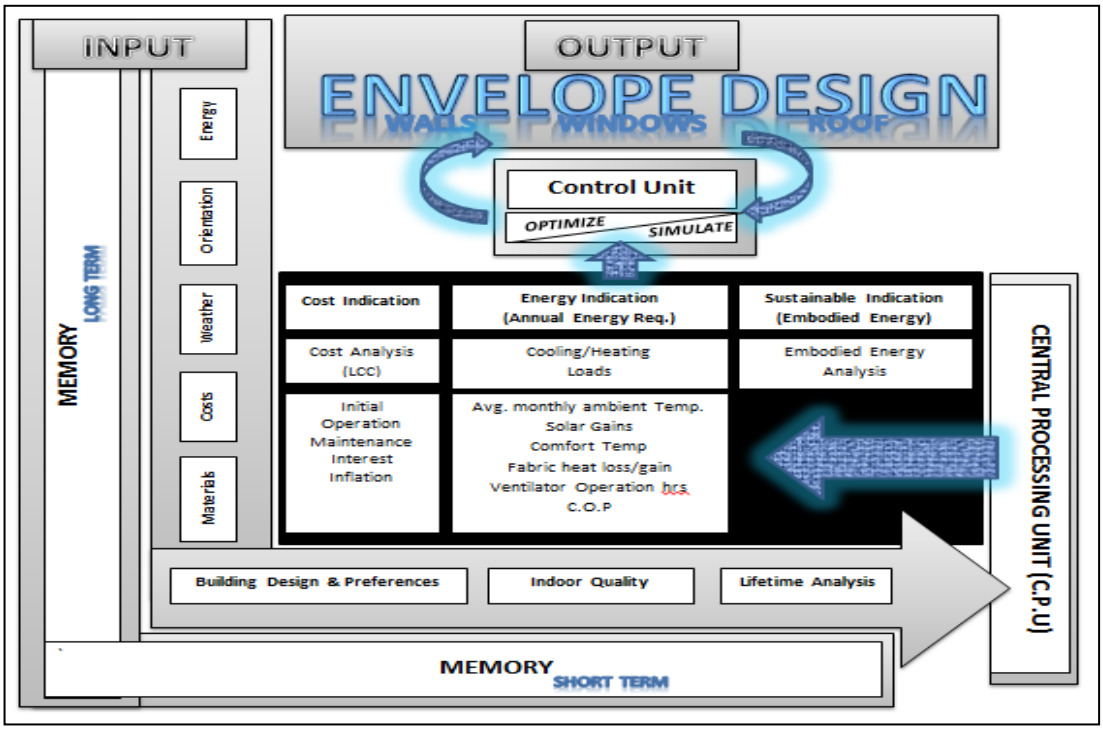

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Figure 1: Proposed Framework

Short term memory mainly stores customized information related to specific building under analysis. Building design and preferences covers geometry information such as: area of building, height of floors, number of floors, area of windows, building location and orientation. Indoor quality covers preferred building interior temperatures in summer and winter. Finally lifetime analysis covers the analysis lifetime of studied building.

1.2 Central Processing Unit

The second module is responsible for doing different design assessments that help in selecting the optimum design. Three main assessments are used which are cost indication, Energy indication and sustainable indication. The first Indication is based upon life cycle cost analysis. It mainly covers initial, operation, maintenance and replacement costs of building envelope systems. Initial costs are mainly the cost of the materials and associated labour/equipment which can easily be retrieved from costs database available in the long-term memory. Operation costs in this research are mainly the electricity costs (LE). Electricity costs depends on number of operating hours of cooling/heating system, its coefficient of performance (C.O.P) and electricity price of 1kw.hr consumption. The central processing unit retrieves all cost values and assesses their repetition along the analysis period for all systems forming the building envelope. All costs are then discounted back resulting in an equivalent net present value (NPV) for the whole building. In this cost assessment, an effective interest rate for each repeated cost is calculated then used in the NPV calculation. The second assessment indication is related to energy demand. This indication assess the amount of heat/cooling load needed to reach satisfactory thermal comfort level. This assessment should be modelled / calculated to estimate the heating/cooling demands for residential buildings. The ASHRAE design book (ASHRAE, 1997) represents one of the easiest manuals to aid in such calculations. The final indication is associated to

sustainability. Sustainable indication is mainly related to the amount of embodied energy for each selected envelope design. Embodied energy includes the considerable amount of energy spent in the manufacturing, processes and transportation of various building materials. The energy content of different building materials/components such as: masonry walls, glass, insulation boards …..etc. can be integrated into a computation of the total embodied energy in a whole building envelope system. The control unit can use different tools for selecting the optimum envelope design. Both Optimization and Simulation can be used and significantly aid in making such decision.

1.3 Control Unit

The control unit is further responsible for selecting the final building envelope design that satisfies the needs of the user. Considerations as costs, adverse impact on environment and performances should all be accommodated. Both optimization and Simulation tools could represent significant aid for the decision making process.

3 Implementation & Analysis

To implement the proposed framework, a spread sheet model had been developed as shown in Figure 2. (a) A sheet is used as an interface which allows feeding the building information and preferences to be stored in the short term memory. (b) Various sheets are used as databases for material, costs, thermal properties, economic data and embodied energy which represent the long term memory of the model. Data used in the model and its source of retrieval are presented in Table 1. Based upon available materials, different design combinations for different systems as walls, windows and roof could be formed, and their technical data could be matched and retrieved.

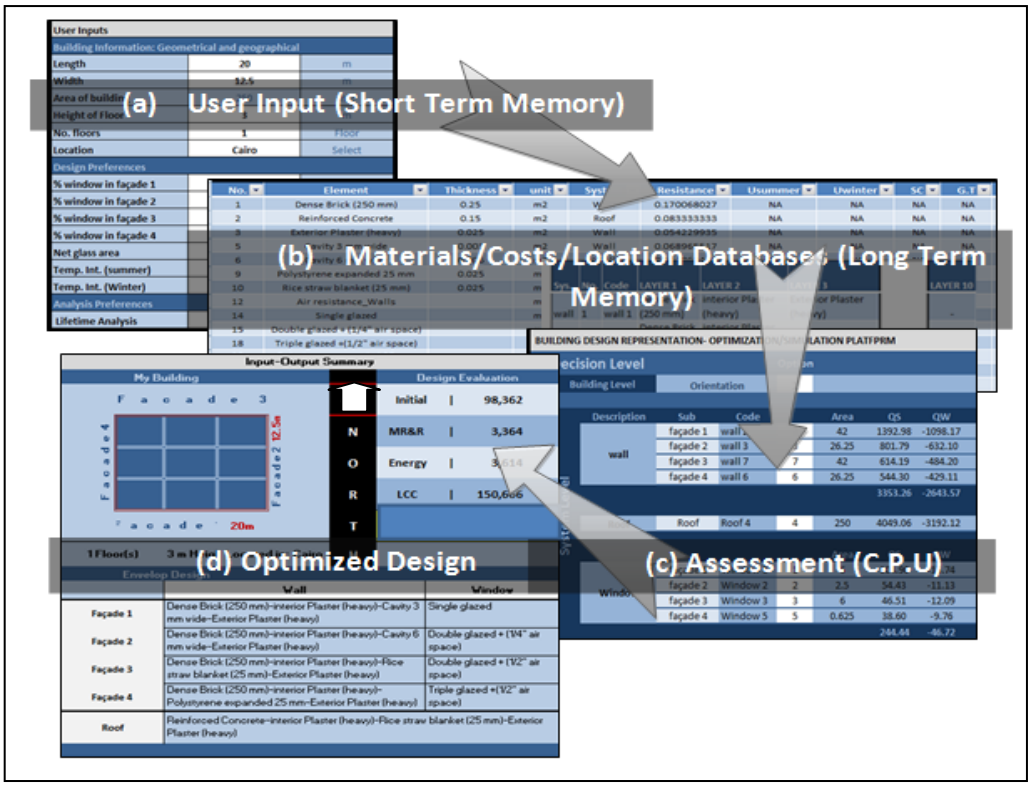

Figure 2: Model Spread Sheets

Sample of available design combinations for different systems for building envelopes are shown in Table 2. (c) A different sheet is used as the C.P.U module, where design assessments are carried. Three main indications are assessed which are costs, energy demand and sustainability. Costs are represented by lifecycle associated costs as initial, operation, maintenance, repair and replacement. Maintenance, repair, operation and replacement costs are all discounted at present value and added to the initial investment to represent the overall lifecycle costs of the building envelope. The ventilator operating cost is based on energy assessment. Energy assessment is based on proper decomposition for mathematical equations following the ASHARE design book (Mc Quiston and Spitler, 1997). The core of heating/cooling load calculation depends on three main calculations: (1) conduction through building walls/roof, (2) conduction through windows and (3) solar radiation through glass, and is shown in Table 3. (d) Finally, a conclusive sheet is presented to show the final optimum building design based upon optimization/analysis. This model uses both EVOLVER 5.5 and Crystal Ball (add-ins for Excel applications) for optimization/simulation purposes.

Table 1: Data type and its source of retrieval

Data Type	Source
Materials, Thermal & Costs data	Recent & available materials/technologies in the Egyptian market
Weather related data	The US department of energy weather data (Weather data, 2012)
Orientation related data	The ASHRAE design book (McQuiston and Spitler, 1997)
Electricity costs (price of 1kw.hr consumption of electricity)	Ministry of Electricity and Energy Cairo. (Egyptian Electricity Holding Annual Report, 2012)
Embodied Energy Information	Materials properties handbooks/publications. (Baird et al.,2007); (Venkatarama and Jagadish, 2003)
Economic data (EGYPT)	Egyptian central agency for public mobilization and statistics (Price Indices, 2011)

Table 2: Sample of Systems Alternatives in the Model Database

Systems	Composition Layers			
Wall 1	Dense Brick	Interior Plaster (heavy 25mm)	Exterior Plaster (heavy)	
Wall 2	Double Dense Brick	Interior Plaster (heavy 25mm)	Cavity (3 mm wide)	Exterior Plaster (heavy 25 mm)
Wall 3	Double Dense Brick	Interior Plaster (heavy 25mm)	Cavity (6 mm wide)	Exterior Plaster (heavy 25mm)
Wall 4	Double Dense Brick	Interior Plaster (heavy 25mm)	Fibre Insulation Board (24 mm)	Exterior Plaster (heavy 25mm)
Wall 5	Double Dense Brick	Interior Plaster (heavy 25mm)	Polystyrene Expanded (25 mm)	Exterior Plaster (heavy 25mm)
Wall 6	Double Dense Brick	Interior Plaster (heavy 25mm)	Rice Straw Blanket	Exterior Plaster (heavy 25mm)
Roof 1	Reinforced Concrete (120 mm)	Interior Plaster (heavy 25mm)	screed	
Roof 2	Reinforced Concrete (120 mm)	Interior Plaster (heavy 25mm)	Polystyrene Expanded (25 mm)	screed
Roof 3	Reinforced Concrete (120 mm)	Interior Plaster (heavy 25mm)	Fibre insulation board	screed

			(24 mm)	
Roof 4	Reinforced Concrete (120 mm)	Interior Plaster (heavy 25mm)	Rice straw blanket (25 mm)	screed
Window 1	Single glazed			
Window 2	Double glazed + (1/4" air space)+ coat (e=0.4)			
Window 3	Triple glazed + (1/2" air space)			

Table 3: Energy Assessment Based on Mathematical Equations Following the ASHARE Design

Energy Assessment (Demand & Costs) Equations	
Equation	**Identification**
Heat gain/loss through walls or roof ($Q_{Wall/Roof}$) $Q_{Wall/Roof} = U.A.\Delta T$	• A = area of element in (m^2), ΔT= temperature difference between inside and outside medium • U= overall heat transfer coefficient
Overall heat transfer coefficient (U) $U= 1/R_{Overall}$	• $R_{Overall}$ = total thermal resistance of the wall/roof depending on its composition
Total thermal resistance of the wall/roof ($R_{Overall}$) $R_{Overall} = R_{Int} + \Sigma R_E + R_{Ext}$	• R_{Int}; R_{Ext} = thermal resistance of the internal and external air film layer respectively. • R_E = thermal resistance of construction element in any multi-layer system.
Heat gain due to solar radiation in (Q_{Solar}) $Q_{Solar} = A_{glass.}$ SC. SHGF. CLF	• A_{glass} = net glass area • SC = shading coefficient of window glass • SHGF = solar heat gain factor for that orientation (watt/m2) • CLF = cooling load factor
Energy Demand (E_D) $E_D = Q_T$/ C.O.P	• Q_T =total amount of heat gain/loss in watts • C.O.P = coefficient of performance of cooling/heating system
Electricity Costs (E_C) $E_C = \Sigma (E_D. H. E_{Price})$	• E_C = Electricity costs per year (EGP /year) • h=number of operating hours of cooling/heating system • E_{price} = price of 1kw.hr consumption of electricity (EGP/kw.hr)

3.1 Optimization

A case study is considered and applied to the developed model. The case study input information is as follows: the building dimensions are 20 x 12.5 m with five floors of 3 meters height each. Windows are 30% of walls area, for the four façades. The user's preference interior temperature in summer is 16 ^oC and in winter is 23^oC. The building location is Al Minya governorate in Egypt, and the building is located that its main façade faces north. Finally, the analysis period covers 50 years. Optimization is set to reach the least lifecycle costs design. The variables are the available different design systems for the building envelope walls, windows and roof, considering their integration effect on each other. The constraint is a maximum allowed embodied energy of one million KJ. The optimum result was the following: for the walls, all walls facades required the wall type with the highest available insulation material and least costs and embodied energy in the database (rice straw blanket, 25 mm) along with double brick layer. For the windows, they are all found to be single glazed. This means that windows insulation does not contribute much to lifecycle costs savings although it does to energy savings. This implies that their relative initial costs outweigh their energy savings. Finally, the roof was optimized to be reinforced concrete with rice straw blanket which is the highest available thermal insulating material of least costs and embodied energy. By reviewing the optimization results, it

was found that the framework selected the green alternatives although the existing of less expensive alternatives in the formed database.

3.2 Simulation

On the other hand, simulation tools are also conducted to study the trade-off between life cycle costs (LE) and embodied energy (MJ), see Figure 3. The Figure shows the different design scenarios and their associated embodied energy and life cycle costs. The left half of the graph represents the least costs available scenarios, while the bottom half of the graph represents the least embodied energy scenarios. Designer can select designs on the left bottom on the drawn curve as they represent least relative costs as well as embodied energy. This trend shows that it is possible to save huge amounts in the life cycle costs with least available embodied energy designs. For example, point 1 represents an optimum building envelope design of least available embodied energy of 218,000 MJ and minimum available lifecycle costs of 177,000 Egyptian pounds.

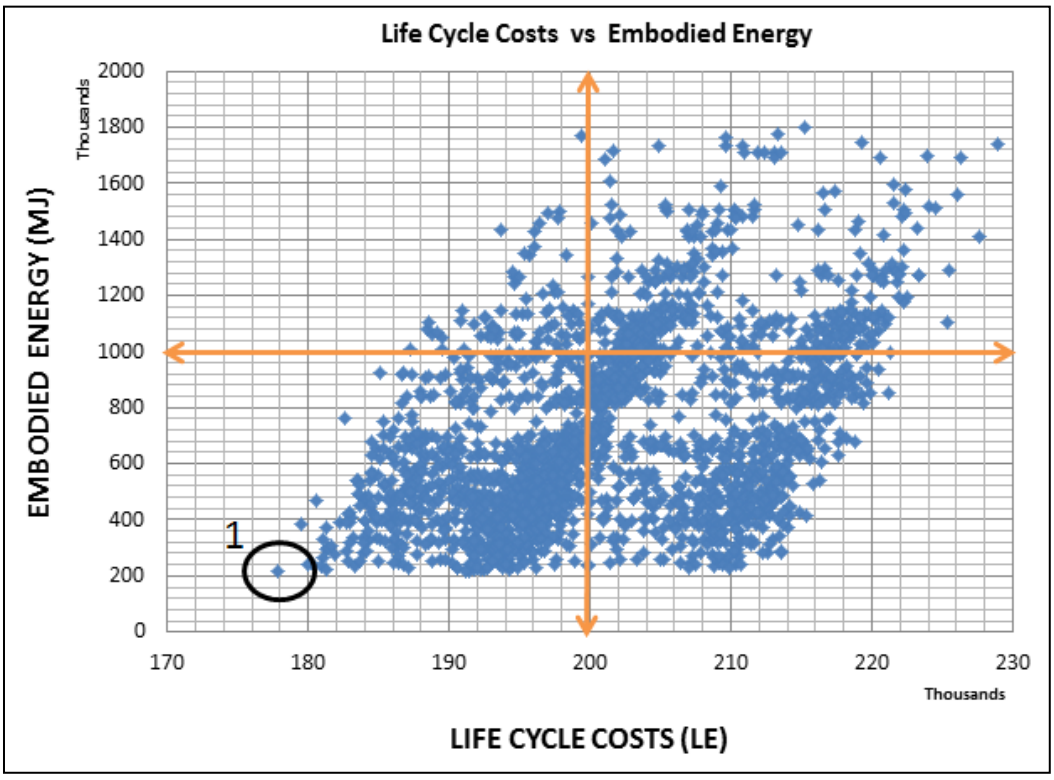

Figure 3: Life Cycle Costs Vs Embodied Energy

4 Conclusions

Different studies were done to optimize buildings design. However, most professionals in the Egyptian sector have neglected sustainable design approaches as they perceive it as being complex, time and money consuming and ineffective. Meanwhile, an integrated approach to reach sustainable building envelope design was presented considering thermal indoor quality, energy demand, embodied energy and lifecycle costs. The framework includes three main Modules: 1- A memory module, 2- A central processing unit module, and 3-A control unit module. Moreover, a new generic model was presented with case study as an application to the model and the

output of model was elaborated. Finally, simulation was conducted showing a trade-off relationship between embodied energy and lifecycle costs of available options. This model can be further accommodated and be used by investors or builder's owners at conceptual design to reach an optimum building envelope design with respect to costs, energy demand and sustainable indicators. The ease and simplicity of the model entries and use would encourage designers and investors to use it. Future work can be incorporated to include more analysis and indicators.

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The Need for Energy Efficiency Legislation in Malaysian Building Sector. A Comparative Study of South East Asian Policies

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Abstract:
The Malaysian building sector approximately consumes 53% of national electricity generated, and emits 5,301 ktons of greenhouse gases (GHG) with an annual growth rate of 6.4%. While voluntary codes of practice for energy efficiency and use or renewable energy exist for non-residential buildings, Malaysia has yet to adopt mandatory energy efficiency legislation for its building sector. Mandatory building energy performance codes have been shown to be the most cost-efficient and effective policy instruments for reducing building energy-related greenhouse gas emissions. Therefore, without mandatory and comprehensive energy efficiency policy, Malaysia faces locking in substantial inefficiencies, and higher than necessary climate change impacts from its building sector. A comparison of energy efficiency policies from other South East Asian countries with similar climatic characteristics will be a valuable insight for Malaysia.

Keywords:
Building control, developing country, energy efficiency, policy development.

1 Introduction

Developing countries in Asia and Africa are rapidly urbanizing, which consequently caused a swift increase of GHG emissions as housing and energy demand escalates (Fujita et al., 2009). South East Asia (SEA) is one of the world's most dynamic regions with progressive economic developments in the past decades (ADB, 2009). The region mainly experiences tropical climate and has a large coastline (173,251 kilometres), which makes it one of the world's most vulnerable regions to the impacts of climate change (ADB, 2009). Already, the region is affected by climate change with rising temperature, rising sea level, and more frequent and extreme weather events that leads to massive flooding and landslides (ADB, 2009).

It is a pressing issue for SEA countries to take action in adapting to climate change, and reduce the environmental impact of energy consumption and GHG emissions that are already locked into the climate system (ADB, 2009). The building sector has been identified by the Intergovernmental Panel on Climate Change (IPCC) as the single largest sector for GHG mitigation potential in all countries (IPCC, 2007; UNEP-SBCI, 2010). A cost-effective global potential up to 80% reduction, of the projected baseline emissions by 2020, has been identified in the building sector (Levine et al., 2007; UNEP-SBCI, 2010; UNEP, 2009). Furthermore, the projected reduction are made available for new and existing buildings with proven and commercially available technologies (UNEP-SBCI, 2010; UNEP, 2009).

Buildings worldwide consume approximately 45% of primary energy sources, making it the single largest energy consumption sector (Iwaro & Mwasha, 2010; Yang et al., 2008). The building sector also globally generates approximately 40% wastes and consumes 16% of water (du Plessis, 2002; WBCSD, 2009). In Malaysia, electricity is the predominant form of energy consumed in buildings (90%), and approximately 53% of the total electricity generated is consumed in the building sector (Energy Commission, 2009). This is further broken down to 18% for residential buildings, and 28% for commercial or non-residential buildings (Shafii, 2008). Currently there is lack of published data for energy performance and actual energy consumption of buildings, especially for residential buildings in Malaysia (Shafii, 2008). Annually the Malaysian building sector emits approximately 5,301 ktons of GHG emissions, with an annual growth rate of 6.4% (UNDP, 2009).

Energy efficiency (EE) legislation exists in almost all developed countries while the developing countries are currently introducing such guidelines on a voluntary basis first to raise awareness among professionals (Iwaro & Mwasha, 2010; UNEP, 2007a, 2009). Energy efficiency legislation such as building energy codes and standards primarily set minimum requirements for energy efficient design and construction (Department for Communities and Local Government, 2007; Iwaro & Mwasha, 2010). Building energy codes are mandatory requirements, enforced to ensure building are constructed and perform according to the minimum energy requirements (Iwaro & Mwasha, 2010). These standards are used to "address energy use of an entire building or building systems such as heating, ventilation and air conditioning" (Birner & Martinot, 2002 p.44), which is also a popular instrument to expedite energy efficiency in the building sector (OECD, 2003; UNEP, 2007a). Conversely, energy standards are used as voluntary guidelines for building construction to promote energy efficiency and save energy cost-effectively (Iwaro & Mwasha, 2010).

2 Effectiveness of Energy Performance-Related Building Codes

It is argued that enforcing energy performance requirements in building codes is the most effective and cost-effective strategy in reducing GHG emissions from both existing and new buildings (UNEP-SBCI, 2009). Regulatory strategies are taken by governments to intervene in the market to achieve and assert changes within the sector (Lee & Yik, 2004). Enforcement of energy efficient building standards through regulatory control can potentially ensure a minimum level of performance is achieved across the building sector (Huovila et al., 2009; Lee & Yik, 2004; UNEP, 2007b). In Asia, energy efficiency initiatives is seen to be largely dependent on governmental

efforts (Hong et al., 2007). Countries in Scandinavia generally implement national building codes that regulates the physical, thermal and electrical requirements of building components, service systems and equipments to help promote energy efficiency (UNEP, 2007b). Building codes have also introduced energy performance standards to limit the amount of energy consumption according to building type (UNEP, 2007b).

Additionally, the effectiveness of these building codes and standards are dependent on level of enforcement and implementation (Birner & Martinot, 2002; Deringer et al., 2004; UNEP, 2007a). Moreover, in order to stay effective, building codes need to be regularly revised as technology advances and costs less (Birner & Martinot, 2002; UNEP, 2007a, 2009). This consequently leads to more efficiency, with the removal of least efficient products and encourage higher efficient product purchase in the market (Birner & Martinot, 2002).

Therefore, unless the criteria levels are easily achieved and does not impose heavy financial burden, the building sector would strongly oppose the legislation, or likely to encounter numerous violations rendering enforcement (Lee & Yik, 2004). Some suggest the voluntary-based environmental approach is more effective, whereby it offers greater flexibility for stakeholders to achieve its target (Lee & Yik, 2002, 2004). Voluntary initiatives are also aimed at influencing behavioural characteristics of individuals and companies, by providing examples of successful implementations (IEA, 2005; UNEP, 2007a). Voluntary agreements usually consist of negotiated energy use reduction targets, quantifying energy consumption and baselines, technical assistance services, sanctions for noncompliance, and incentives for compliance (IEA, 2005).

However, based on experience in public sector buildings with mandatory energy reduction programme have shown significant cost-effective energy savings. Federal agencies in the U.S. were obliged to reduce their energy consumption by 35% by 2010 compared to 1990 levels, which led to energy savings of 4.8 GWh annually (equivalent to 2.3 ktCO2e.) and cost savings of USD$ 5.2 billion (U.S. DOE, 2006 cited in UNEP, 2009). Mandatory energy efficiency building codes also provides an incentive for the private sector to invest in new technologies (UNEP, 2009).

3 Energy Efficiency Building Codes in South East Asia (SEA)

In many developing countries, energy efficiency building codes (EEBCs) exist only on paper and have failed to impact significant energy savings (Deringer et al., 2004; UNEP, 2007a). This is due to lack of enforcement, corruption, and different levels of rigor implementation (Birner & Martinot, 2002; Deringer et al., 2004; UNEP, 2007a). Additionally the United Nations 'Assessment report on energy efficiency institutional arrangements in Asia' (UNESCAP, 2010), countries in SEA share common barriers in promoting energy efficiency, i.e. lack of industrial awareness, lack of financial capacities, and lack of confidence in technology (UNESCAP, 2010).

For example, EEBCs are strictly enforced in Singapore, while EEBCs in the Philippines National Building Code only considers energy efficiency a voluntary requirement (OCEAN, 2009). Similarly, Thailand's Building Energy Code is mandatory for all commercial and government buildings, while Vietnam's mandatory Energy Efficiency Commercial Code hasn't been widely disseminated and not strictly enforced (OCEAN,

2009). Brunei, Cambodia, Lao PDR, Malaysia and Myanmar have yet to implement any mandatory EEBC, but some have introduced voluntary EE guidelines, conservation programmes, or codes for non-residential buildings (OCEAN, 2009; UNEP & BCA, 2011; UNESCAP, 2010). This reflects the lack of awareness, the different levels of implementation and enforcement of EEBCs across SEA. Brief comparison of existing EEBCs in SEA is presented in Table 1, thus presenting the current state of play.

Table 1. Energy Efficiency Policies in Building Sector for South East Asian Countries

(Source: APERC, 2011; UNEP & BCA, 2011)

Country	**Energy Efficiency Policies and Building Codes in SEA**	
	Mandatory	**Voluntary**
Brunei Darussalam	N/A	Energy audits, EE Building Guidelines, EE and Conservation Initiative Awards Scheme, EE Labelling Scheme.
Cambodia	N/A	Energy Audits in Commercial Buildings, Promotion of EE and Conservation (PROMEEC)
Indonesia	Building Codes-Energy Provision, Mandatory energy conservation for government buildings, Energy Building Standards (SNI), Minimum Energy Performance Standards and Labelling, Presidential Instruction No.9/1982-Energy Conservation; No.10/2005-EE and energy saving; No.13/2010-Energy Manager; No.14/2010-Building Managers.	EE Labelling Systems, GREENSHIP Building Rating Tool, Public-Private Partnership Programme on Energy Conservation, Energy Conservation Clearinghouse, Energy Benchmark and Best Practice Guide (for commercial buildings).
Lao PDR	N/A	Promotion of EE and Conservation (PROMEEC)
Malaysia	N/A	Energy Rating and Labelling Programme, Malaysian Standard-Code of Practice on the Use of Renewable Energy and EE in Non-Residential Buildings (MS1525:2007), Green Building Index (GBI), Energy Performance Management Systems (EPMS)– energy audits on government buildings
Myanmar	N/A	N/A *only a general Energy Policy and Strategy, Energy Conservation Model Project.
The Philippines	Building Codes-Guidelines for Energy Conservation Design of	Building for Ecologically Responsive Design Excellence

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	Buildings and Utility Systems, Mandatory EE Labelling, Government Energy Management Programme (GEMP) – energy audits, Malacanang Administrative Order (OA) No. 103, 183, 228.	(BERDE) Building Rating System, Green Building Initiative (GBI) Rating System, EE Standard and Labelling Programme, Energy Audits by Dept. Of Energy under National EE Conservative Programme (NEECP), GEMP Award.
Singapore	Minimum Energy Performance Standards (MEPS), Building Control (Environmental Sustainability) Regulations, Code on Envelope Thermal Performance for Buildings, Code of Practice for EE Standard for Building Services and Equipment, and Code of Practice for Air-Conditioning and Mechanical Ventilation in Buildings, Mandatory Energy Labelling Scheme (MELS).	Green Mark Schemes, Singapore Green Building Product Certification Scheme, Eco-Office Label, Singapore Green Labelling Scheme (SGLS), EE Building Benchmarking Programme, online benchmarking system (Energy Smart Tool), Built Environment Leadership Award, Green Mark Champion Award.
Thailand	Building Energy Code, Minimum Energy Performance Standards (MEPS), Designated Buildings/Factories under Energy Conservation Promotion Act, Mandatory Audits under Building Energy Code (for designated buildings).	Green Leaf Programme, Thai Green Label Scheme, EE Labelling (No.5), High Energy Performance Standards (HEPS), EE Building Labelling Scheme, Government Buildings Audit and Retrofit Programme, Private Building Energy Audits.
Vietnam	EE Building Code, EE Standards and Labels, EE Commercial Building Code, Public Procurement of Works and Constructions–Law on Construction (No.16/2003/QH11), Law on Environmental Protection (No. 52/2005/QH11).	LOTUS VN Green Rating Tool, ASEAN Energy Management Scheme, Promotion on EE and Conservation (PROMEEC).

This energy efficiency policies comparative study for South East Asian building sector is mainly compiled from the Sustainable Building Policies on Energy Efficiency reports (UNEP & BCA, 2011) and the Compendium of Energy Efficiency Policies of APEC Economies (APERC, 2011). The comparison mainly focuses on policies related directly with the building sector, such as building codes, EE standards, and energy labelling schemes. It can be concluded that most countries in SEA has already implement mandatory EE policies related to the building sector. However, even if these policies were in place, the more pressing question now is to what extent is its effectiveness in

addressing environmental issues. Presented below are excerpts of each South East Asia's EEBC.

3.1 Brunei

Brunei is in the midst of introducing its own Energy Efficient Building Guidelines, that is expected to become a mandatory legislation and in supplementing the existing National Building Code (APEC, 2011a; UNEP & BCA, 2011). The guideline is set to cover building envelope, cooling and ventilation, lighting, heating, insulation, site orientation, and building design (UNEP & BCA, 2011). Albeit any mandatory guideline, there has been some voluntary initiative taken by the government and industry.

Voluntary energy audits were conducted to both government and industrial buildings to help determine the consumption pattern of Brunei's building stock (UNEP & BCA, 2011). This initiative was in collaboration with the Energy Division of the Prime Minister's Office, the Conservation Centre of Japan and the ASEAN Centre for Energy (UNEP & BCA, 2011). An Energy Efficiency and Conservation Initiative Awards Scheme was initiated in 2007, by the government and private organizations, in hopes to exemplify energy efficiency and conservation efforts (UNEP & BCA, 2011). The government also launched a voluntary Energy Efficiency Labelling Scheme targeting commercial, residential and government buildings, to raise awareness on more energy efficient product (at present only air-conditioners are being labelled as it represents the bulk of electricity consumption) (UNEP & BCA, 2011).

3.2 Cambodia

Cambodia has taken steps in promoting energy efficiency through voluntary programmes such as Promotion of Energy Efficiency and Conservation (PROMEEC) with the Energy Conservation Centre of Japan (ECCJ) (UNEP & BCA, 2011). PROMEEC aims to establish a standardized evaluation criteria for energy conservation, introduce energy conservation technologies, encourage and award best practices for buildings and other major industries (UNEP & BCA, 2011). Another example is through series of activities for capacity building and technical assistance, conducted by a French Agency for the Environment and Energy Management together with the Energy Conservation Research and Development Centre (ENERTEAM) (UNEP & BCA, 2011).

Cambodia also participates in the ASEAN Energy Awards, which promotes regional cooperation and partnerships between the private and public sectors (UNEP & BCA, 2011). Voluntary energy audits are also carried out on commercial buildings in efforts to promote more energy efficiency measures (UNEP & BCA, 2011). However, there is currently no mandatory regulation, no building rating scheme and is yet to develop any fiscal instruments to widely disseminate energy efficiency within the building sector (UNEP & BCA, 2011). Therefore, Cambodia needs to play catch up with its other SEA counterparts, in preventing potentially high inefficiency lock-in effect.

3.3 Indonesia

Indonesia applies mandatory energy conservation best practice measures for all its government office buildings, which is expected to submit monthly energy consumption

report every six months (APEC, 2011a; UNEP & BCA, 2011). Other mandatory frameworks are such as Law No.28/2002 regarding Buildings, which requires all buildings to comply with existing energy standards (SNI) that applies to building envelope, air-conditioning, lighting, and energy auditing (APEC, 2011a; UNEP & BCA, 2011). The Presidential Instruction No.10/2005 on Energy Efficiency requires government officials to implement EE measures such as lighting, air-conditioning, electrical appliances and office vehicles, within its institutions (UNEP & BCA, 2011). A Minimum Energy Performance Standards (MEPS) is also being developed to encourage energy efficiency through energy labelling for appliances (UNEP & BCA, 2011).

The Green Building Council of Indonesia introduced a voluntary green building rating tool, the GREENSHIP in 2008 (UNEP & BCA, 2011). GREENSHIP rates the environmental design and construction of buildings through six criteria; appropriate site development; energy efficiency & refrigerants; water conservation; materials & cycle resources; water, indoor health & comfort; and buildings & environment management (UNEP & BCA, 2011). A Public-Private Partnership Programme on Energy Conservation was introduced, by the government, to improve energy efficiency for industries and buildings with intense energy consumption (UNEP & BCA, 2011).

3.4 Lao People's Democratic Republic (PDR)

Currently, no legal framework for improvement of energy efficiency and conservation exists within the building sector in Lao PDR (ECCJ, 2011). The Ministry of Energy and Mines (MEM) is in the process of drafting a decree on Energy Efficiency and Conservation to encourage conservation measures in public buildings (ECCJ, 2011). Nevertheless, Lao PDR has taken steps to introduce energy efficiency by participating in the Promotion of Energy Efficiency and Conservation Project (PROMEEC) since 2001, similar to Cambodia and Vietnam (ECCJ, 2011). This project is aimed to provide capacity building on energy efficiency and conservation, in disseminating best practices and experiences from Japan to other ASEAN member countries (ECCJ, 2011).

3.5 Myanmar

Similar to Brunei, Cambodia and Lao PDR, Myanmar has yet to implement any mandatory energy efficiency legislation within its building sector (UNEP & BCA, 2011). Incidentally, available energy efficiency and conservation voluntary actions has so far only appear in the energy production industry (UNEP & BCA, 2011). However, energy conservation seminars have been conducted to raise awareness and promote for more energy efficient equipments in commercial buildings and electrical appliances in households (UNEP & BCA, 2011).

An Energy Policy and Strategy exits for the energy production sector, to encourage renewable sources and conservation of non-renewable energy sources (UNEP & BCA, 2011). The Ministry of Energy has also introduced the Energy Conservation Model Project, to conduct a feasibility study of energy demand and consumption of the industry sector, in efforts to develop energy efficiency and conservation policies that is unique to the current energy trends (UNEP & BCA, 2011). Myanmar also engages in a regional energy corporation between Bangladesh, India, Sri-Lanka and Thailand-Economic Corporation (BIMST-EC), for capacity building and technology transfer programmes and activities (UNEP & BCA, 2011). These initiatives are encouraging,

however more effort and focus must trickle down to the building sector in preventing a future lock-in of an inefficient building sector.

3.6 The Philippines

The Philippines introduced the Guidelines for Energy Conservation Design of Buildings and Utility Systems into its National Building Code (Republic Act No. 6541) (OCEAN, 2009; UNEP & BCA, 2011). However, the particular energy efficiency section of this building code is presently only as a voluntary basis, an only concerns building envelope, lighting, HVAC (heating, ventilation, and air conditioning), and water heating (OCEAN, 2009). A mandatory Energy Efficiency Labelling scheme was introduced to label energy efficient refrigerators, window-type air-conditioners, compact fluorescent lamps and linear fluorescent lamps; targeted at all types of building (UNEP & BCA, 2011).

Other regulatory instruments such as Malacanang Administrative Order (AO) No. 103, No. 183 and No. 228 has set requirements for public buildings facilities to achieve a 10% reduction in cost for consumption of fuel, water, office supplies, electricity (UNEP & BCA, 2011). The AO also requires public buildings to use energy efficient lighting systems, to turn off air-conditions at 4.30pm except those operate 24 hours daily, convert 20% of vehicles to liquefied petroleum gas, and to apply energy saving technologies (UNEP & BCA, 2011). Energy audits are also conducted for government buildings, under the Government Energy Management Programme (GEMP) (UNEP & BCA, 2011). Tax exemptions/reductions, grants and capital subsidies are also available via the government and other public institutions as fiscal instruments to promote energy efficiency (UNEP & BCA, 2011).

There are voluntary rating systems such as the Building for Ecologically Responsive Design Excellence (BERDE) and the Green Building Initiative (GBI), where one measures a building's environmental impact and performance throughout life cycle analysis (LCA), and the other focuses on green building design criteria (UNEP & BCA, 2011). Many building awards based on best practice of eco-friendliness, energy efficiency, and energy management are both voluntary instruments and market-lead to help promote a more energy efficient built environment (UNEP & BCA, 2011).

3.7 Thailand

Thailand's Energy Conservation Promotion Act (No. 2 B.E. 2550) enforces energy conservation practices for industrial, commercial and government building sectors (OCEAN, 2009). Additionally the Building Energy Code was introduced in 1994 and enforced in 1995, which covers building envelope, HVAC and lighting requirements (OCEAN, 2009). The mandatory code is applicable to all new and existing commercial and government buildings, in complying with the maximum standard of 55 watts per square meter (m^2) of gross floor area (g.f.a) (OCEAN, 2009).

Under the Building Energy Code, two specific decrees are imposed; Royal Decrees on Designated Buildings (B.E. 2538) and Royal Decree on Designated Factories (B.E. 2540). The B.E. 2538 prescribes "a) the standards, criteria, and procedures for energy conservation in designated buildings; b) the forms and schedule for submission of information on energy consumption and conservation; and c) the criteria, procedures and schedule for owners of designated buildings to establish and submit energy

conservation targets and plans" (APERC, 2011 p.208). Meanwhile the B.E. 2540 imposes "a) the forms and schedule for submission of information on energy production, consumption and conservation, including the criteria on and methods of recoding information on energy consumption and installation or modification of machinery or equipment that affects the level of energy consumption and conservation; and b) the criteria, procedures and schedule for owners of designated factories to establish and submit energy conservation targets and plans" (APERC, 2011 p.208).

Other regulatory instruments implemented as like the Minimum Energy Performance Standards (MEPS) and mandatory energy efficient refrigerator/air-conditioner programme (UNEP & BCA, 2011). The MEPS standard defines an energy efficiency performance threshold for six electrical appliances, such as refrigerators, air-conditioners, motors (three phase), fluorescent lighting ballast, fluorescent lighting tubes, and compact fluorescent lamps (UNEP & BCA, 2011). The Energy Efficient Air-Conditioner Programme (EEAP) and Energy Efficient Refrigerator Programme (EERP) are mandatory energy labelling for air-conditioners and residential-use refrigerators (UNEP & BCA, 2011).

Fiscal instruments aimed at providing tax exemption, corporate funds, and household energy credits are exemplary initiatives by the Thailand government and public sectors to highlight energy efficiency issues (UNEP & BCA, 2011). There are also a variety of voluntary initiatives done by both the public sector and the industry to push for energy efficiency, such as the Green Leaf Programme, the Thai Green Label Scheme, High Energy Performance Standards (HEPS), Government and Private Buildings Audit and Retrofit Programmes, and the Building Energy Awards of Thailand (BEAT) (UNEP & BCA, 2011).

3.8 Vietnam

Vietnam introduced its Energy Efficiency Building Code (No.40/2005/QD-BXD) and consequently the Energy Commercial Building Code (No.40/2005/QB-BXD) in 2005 (OCEAN, 2009; Pham, 2011). These mandatory codes cover building envelope, lighting, air-conditioning and ventilation, and are applicable to public, residential and non-residential buildings (APEC, 2011a; UNEP & BCA, 2011). Additionally, the Public Procurement of Works and Constructions, via Law on Construction (No.16/2003/QH11) and Law on Environmental Protection (No.52/2005/QH11), requires construction projects in Vietnam to submit an Environmental Impact Assessment (IEA) documentation (UNEP & BCA, 2011).

A Pilot Commercial Energy Efficiency Programme (CEEP) was introduced from receiving the Global Environment Facility (GEF) grant from the World Bank (UNEP & BCA, 2011). The CEEP (2004 to 2009) was aimed to increase capacity building in energy efficiency and conservation for organizations, and provided financial support for the private sector (UNEP & BCA, 2011). Other voluntary instruments are such as the LOTUS Green Rating Tool, ASEAN Energy Management Scheme and the Promotion on Energy Efficiency and Conservation (PROMEEC) programme (UNEP & BCA, 2011). The LOTUS Green Rating Tool was developed in 2010 by Vietnam's Green Building Council (VGBC) (UNEP & BCA, 2011). Currently, LOTUS is available in three categories, i.e. residential, non-residential and existing buildings (VGBC, 2011). LOTUS rates a building through nine criteria, i.e. energy, water, material, ecology,

waste and pollution, health and comfort, adaptation and mitigation, community, and management (VGBC, 2011).

3.9 Singapore

In comparison, Singapore's extensive sustainable building and energy efficiency commitment is reflected in its various initiatives that range from regulatory legislation, fiscal instruments, market-driven initiatives and voluntary schemes. Singapore introduced its Building Control (Environmental Sustainability) Regulations in 2008 (BCA, 2008; UNESCAP, 2010). This legislation requires all new buildings (residential and non-residential) and additions/extensions to existing buildings, with gross floor area of 2,000 square metres or more, to comply with a minimum Green Mark Score of 50 points (BCA, 2008; UNESCAP, 2010). The Green Mark assesses buildings by its energy efficiency (minimum 30 points), and other green requirements (minimum 20 points) such as water efficiency; environmental protection; indoor environmental quality; and other green features (BCA, 2012).

Aside from that, other relevant building codes implemented in Singapore are Code on Envelope Thermal Performance for Buildings, Code of Practice for Energy Efficiency Standard for Building Services and Equipment, Code of Practice for Air-Conditioning and Mechanical Ventilation in Buildings, Code of Practice for Artificial Lighting in Buildings, and Code of Practice for Lighting of Work Places-Indoor (UNEP & BCA, 2011; UNESCAP, 2010). The Code on Envelope Thermal Performance for buildings focuses on thermal transfer value of building envelope and roofs for air-conditioned non-residential buildings, envelope transmittance value for residential buildings, and roof insulation for air-conditioned buildings (APEC, 2011a; UNEP & BCA, 2011).

Additionally, under the Mandatory Energy Labelling Scheme (MELS), selected household appliances such as air-conditioners, refrigerators and clothes dryer sold in Singapore must include energy labelling (APEC, 2011a; UNEP & BCA, 2011). This is tied together with the Minimum Energy Performance Standards (MEPS), which requires air-conditioners and refrigerators sold to comply with a minimum level of energy efficiency (APEC, 2011a; UNEP & BCA, 2011). Singapore has also introduced the Energy Efficiency Building Benchmarking Programme to "promote energy efficiency in the building sector by recognizing energy efficient buildings (UNESCAP, 2010 p.85). The programme uses an online benchmarking system, the Energy Smart Tool, to evaluate energy performance based on air quality, thermal comfort, ventilation and lighting (National Environment Agency, 2011).

Fiscal instruments were also introduced by the government, in terms of tax exemptions/reduction, and various energy efficiency financial schemes and grants provided by the public sector (UNEP & BCA, 2011). A One-Year Accelerated Tax Depreciation Allowance for Energy Efficiency Equipment and Technology (One-Year ADAS) is an initiative by the government to encourage companies to invest in energy-saving equipment by providing tax allowance when replacing old and less efficient equipments (UNEP & BCA, 2011). Other fiscal support are such as Energy Efficiency Improvement Assistance Scheme (EASe), Grant for Energy Efficiency Technologies (GREET), Design for Efficiency (DfE) Scheme, and Green Mark Incentive Schemes (GMIS) (APEC, 2011a; UNEP & BCA, 2011).

4 The Need for Energy Efficiency Legislation in Malaysia

Using an energy index (total energy used in a building divided by gross floor area), estimation of the average energy consumption for a standard non-residential Malaysian building is between 250-300 kWh/m^2/year (Shafii, 2008; Zain-Ahmed, 2008b). In comparison, Singapore's average non-residential building energy consumption is at 220 kWh/m^2/year, while South East Asia's region average is at 230 kWh/m^2/year (Shafii, 2008; Zain-Ahmed, 2008b). The Malaysian building stock in approximately at 38 million m^2 floor area, and of which 11% of the buildings can be considered as energy efficient (consumes less than 136 kWh/m^2/year) (UNDP, 2009).

This clearly indicates that the Malaysian building sector is an energy intensive sector of the economy, and energy efficient strategies and guidelines is needed in order to reduce its overal energy consumption. The sustainable construction approach is still at its infancy phase for the Malaysian industry (Hezri, 2004). Additionally, Malaysia still lacks a consistent GHG emissions database (Fong et al., 2008) to further monitor its progress in the presented strategies. This is a key issue that needs to be addressed if Malaysia aims to achieve its voluntary 40% GHG reduction from the 1990 baseline, by year 2020 (Department of Environment, 2010).

Nevertheless, efforts by professional bodies like Architect Association Malaysia (PAM) and Association of Consulting Engineers Malaysia (ACEM) in Malaysia have served as a catalyst in addressing environmental issues in the building sector. The Green Building Index (GBI) Malaysia, created in collaboration by PAM and ACEM, rates building based on energy efficiency, indoor environmental quality, sustainable site planning and management, materials and resources, water efficiency and innovation (Greenbuildingindex, 2009). The GBI currently only applies for non-residential (existing and new), residential (new only) and townships (Greenbuildingindex, 2009). However, there is currently no reference for measuring GHG emission during building operational phase in the GBI assessment criteria, which reflects the lack of research and development into operational emission of buildings in Malaysia.

Also recently introduced in 2009 were tax exemptions and financial incentives by Ministry of Energy Green Technology and Water in attempts to generate interest for more green construction (Ministry of Energy Green Technology and Water, 2009). Such financial incentives are designated for energy efficiency, production and consumption of renewable resources, and green buildings (Ministry of Energy Green Technology and Water, 2009).

4.1 Lack of Energy Efficiency Building Codes in Malaysia

The Malaysian Standard Code of Practice on Energy Efficiency and Use of Renewable Energy for Non-residential Buildings (MS 1525:2007) was introduced in 2001, and revised in 2007, to guide the effective use of energy (including renewable energy) in new and existing non-residential buildings (SIRIM, 2004; Zain-Ahmed, 2008a). Also according to the MS 1525, the recommended amount of energy consumption for non-residential buildings is 135 kWh/m^2/year (Shafii, 2008; SIRIM, 2007; Zain-Ahmed, 2008b). As the average non-residential building in Malaysia consumes between 250-300

kWh/m^2/year, it noticeably implies that more drastic strategies are needed to comply with the energy efficiency guideline.

The Malaysian building sector is regulated by the Uniform Building By-Law (UBBL) that governs the minimum specifications that includes ventilation, structural and constructional requirements, fire safety (APEC, 2011b; Ministry of Finance, 2006). The by-law however does not include energy performance or energy efficiency guidelines, and the voluntary MS 1525:2007 is being used by the government as efforts to promote energy efficiency for the commercial sector (APEC, 2011b). However, the MS 1525:2007 is planned to be incorporated in the UBBL by 2015, under the National Energy Efficiency Master Plan (NEEMP), an initiative by the Ministry of Energy, Green Technology and Water (MEGTW) (APEC, 2011b).

The MEGTW has also been promoting energy efficiency to government-owned buildings. The Ministry's headquarters implemented a Low Energy Office (LEO) strategy, in efforts to reduce its energy consumption (MEGTW, 2009; Shafii, 2007). In 2006, an energy audit conducted to the LEO building and calculated its energy consumption was 104 kWh/m^2/year, which subsequently won ASEAN Building Energy Award (MEGTW, 2009; Shafii, 2007). Other non-residential buildings that have adapted energy efficiency strategies are like the Malaysian Energy Centre's Zero Energy Building in Bangi (ZERO building), the Energy Commission's Diamond Building in Putrajaya, and the Securities Commission Building in Kuala Lumpur (Shafii, 2007; Zain-Ahmed, 2008b). The ZERO and Diamond buildings were designed to reduce energy consumption to 50 kWh/m^2/year and 85 kWh/m^2/year, respectively (Zain-Ahmed, 2008b).

Albeit these incentives, and more significantly, a similar energy efficiency standard for the residential sector does not exist (SIRIM, 2004; Zain-Ahmed, 2008a). Residential buildings are not regulated nor promoted for energy efficiency, which is likely to have a significant implication on its energy end-use performance (APEC, 2011b). Without such legislation, the residential sector in Malaysia is locking itself for a predicted growth of GHG emission through building operation as purchasing power increases.

5 Conclusion

Malaysia falls behind in terms of implementing energy efficiency building codes compared to its other SEA counterparts. From the listed SEA energy efficiency policy and initiatives, Malaysia has a wide variety of examples to help design its own energy efficiency building code. These examples are furthermore applicable to the Malaysian context, as most of the countries share the same climatic conditions. Energy efficiency standard and guideline in the building sector has proven to reduce energy consumption and consequently help reduce total GHG emissions. The apparent gap for the residential sector in energy-efficiency research and legislation, coupled with rising trend of GHG emission, is set to put Malaysia at high risk of locking in high consumption and low-efficiency building. Therefore, to negate this lock-in effect, both residential and commercial sectors need to develop baselines for monitoring and mitigating GHG emissions from building operations. It is also crucial for stakeholders in the building industry to promote existing guidelines to reduce its overall environmental impact.

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Understanding the Influences that Generate Environmental Outcomes of Building Projects: Developing the Theoretical Framework

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Abstract:
Society has an understandable desire to protect the environment, and this protection is reasonably extended to include the impact of building operations through various regulatory controls. However experience has shown that application of the same regulations in different contexts has resulted in very different levels of environmental protection and preservation. These outcomes are situated at the confluence of drafting and implementation of regulations, the monitoring and enforcement of those regulations and the intentions and actions of various stakeholders in the built environment. Although these are typically described in terms of a series of linear processes and interactions the reality is that the levels of ambiguity, informality, and interconnectedness inherent in their interactions are highly complex, and unique to each development. This paper proposes that a systems theory perspective would be beneficial in uncovering processes at work in the Environmental Preservation System, and presents a theoretical construct to that end.

Keywords:
Construction, environment, management, regulation, systems

1 Introduction

At the United Nations Conference on Environment and Development in 1992, the principles of Ecologically Sustainable Development (ESD) were formally adopted through Agenda 21. Signatory countries to Agenda 21, including Australia, acknowledged the adverse impact that human activities were having on the environment (ESDSC, 1992). Within Australia the Commonwealth government signified its commitment to Agenda 21 through the introduction of a plethora of regulatory policies aimed at achieving the principles of ESD and mitigating environmental degradation (Maund & London, 2009). On a State level, the New South Wales (NSW) government enacted the directives issued by the Commonwealth and introduced additional policy; whereby, they have produced what some consider to be an overly legalistic, complex and perplexing legislative system that may not fulfil objectives associated with environmental preservation.

Many of these regulatory controls impact directly upon the development and construction industry which has remained the most rapidly expanding sector, with an annual economic contribution of approximately $45 billion (Australian Bureau of Statistics [ABS], 2012).With such input the consequence has been the gradual exhausting of natural resources and irreversible environmental degradation (Hendrickson and Horvath, 2000; Li, Zhu & Zhang, 2010; Shen & Tam, 2002; Tam, Tam, Zeng & Chan, 2006).

It is not well understood whether current NSW State environmental planning regulation exerts sufficient control over on-site construction practice, particularly in relation to implementation of regulations, associated monitoring and enforcement operations. Interaction of these variables is considered highly complex and subject to ambiguity, informality and interconnectedness. The dilemma is compounded with these variables governed by industry stakeholders: the subjective human element. In effect, the actual ability of the current legislative system to cultivate environmental preservation remains undetermined. The problem appears to be one of a systemic nature and it is proposed that adoption of a systems theory approach would be beneficial.

Stewart and Ayres (2002) explained that 'for policy problems characterised by complexity (such as those concerned with environmental management and regulation, and urban re-development) using systems concepts offers a way of rationalising aspects of existing practice and of suggesting directions for improvement' (p. 79). Therefore, systems theory offers the opportunity to investigate interactions between regulation, enforcement and information flow with on-site construction operations to identify where critical interactions reduce effectiveness and thereby reduce environmental preservation.

Ideas proposed throughout this paper form part of a PhD thesis which is currently in the conceptual stage with an objective to develop a theoretical framework demonstrating how government regulations related to environmental planning influence environmental outcomes of on-site construction operations. It is suggested that systems theory would provide an investigative tool to rigorously interrogate interactions and critically analyse policy with regard to environmental management operations and outcomes. Although primary data collection will be confined to New South Wales, findings may inform wider national and international practices.

2 The Research Context

Within the literature it has been acknowledged that construction operations generate negative effects upon the environment (Shen and Tam, 2002; Tam, Tam, Zeng & Chan, 2006). Accordingly, Shen and Tam (2002) state that 'construction is not by nature an environmentally friendly activity' (p.535). The copious negative environmental impacts that result from industry practice may lead to environmental degradation and the exhaustion of natural resources (Shen and Tam, 2002; Tam, Tam, Zeng & Chan, 2006).

Impacts such as resource extraction related to fossil fuels and resource consumption affecting water, energy and materials significantly contribute to detrimental consequences. Environmental impacts fluctuate from toxic air emissions that include hydrochloric acid, chlorine, ammonia and methanol in addition to sulfur dioxide, nitric

oxide and volatile organic compounds. Tangible impacts affect both water and soil including solid, liquid and hazardous waste production and the contamination of land via chemical emissions (Hendrickson and Horvath, 2000; Shen and Tam, 2002). Although the actual impacts depend on the nature and method of construction, it is undeniable that all construction operations result in environmental degradation.

Theoretically, negative environmental consequences of construction operations may be a result of limitations within the regulatory domain. However, deficiencies in State regulation and enforcement mechanisms although responsible for achieving ESD, do not operate in isolation. Inadequate information flows within the subsystems of the environmental preservation system (see figure 1) and stakeholder interactions may also contribute to produce a significant disconnect with the consequence of potential ineffective environmental management practices. The research proposes to investigate regulatory policy, enforcement and information processes: a systems approach, to unveil the processes at work in the environmental preservation system and how they impact on-site construction environmental management.

3 Regulatory Policy

Policy may be considered a mechanism employed by organisations to regulate specific activities to achieve a set objective. Lee and Yik (2004) state: '…policies are institutional arrangements that influence the decision making of individuals and firms as they attempt to maximise their benefits under the constraints imposed by the policies' (p. 494). In this respect, a policy may be established by any organisation to manage set operations to ensure compliance with a set regime.

This research will explore regulatory policy, legislation, through a systems approach rather than individual organisational policy. Regulatory policy poses a slightly different definition in that it entails '…a set of authoritative rules accompanied by a mechanism, usually administered by a public agency, for monitoring and promoting compliance with those rules' (Johnstone and Starr, 2004, p. 4). It is this form of policy that is encompassed within the environmental preservation system presented in figure 1. The inauguration of regulatory policy within the environmental and planning domain involved formation of law where strict compliance was mandated. Enforcement was the mechanism employed to ensure conformity where violations may promote prosecution. This regulatory approach has been entitled the command and control approach (Lee and Yik, 2004). However, with the current proactive trend to encourage environmentally sound practices, regulation has evolved to incorporate flexible mechanisms that engage stakeholders into compliance. Typically, subsidies, taxes and voluntary agreements are employed to encourage compliance (Johnstone and Starr, 2004).

Although contemporary regulation has adopted a certain degree of flexibility, enforcement continues to play a major role in the environmental preservation system. Enforcement becomes the instrument by which compliance with regulatory policy is attained: a control mechanism. The objective of enforcement is to introduce accountability for violations against regulatory policy (United State Environmental Protection Authority [US EPA], 2012; Johnstone and Starr, 2004). The US EPA (2012) explains that ''…civil and criminal enforcement is an important part of ensuring

governments, companies and individuals meet their environmental obligations'. Even with the current combination of regulation, flexible arrangements and enforcement it remains questionable as to whether any real improvements in construction environmental management have occurred.

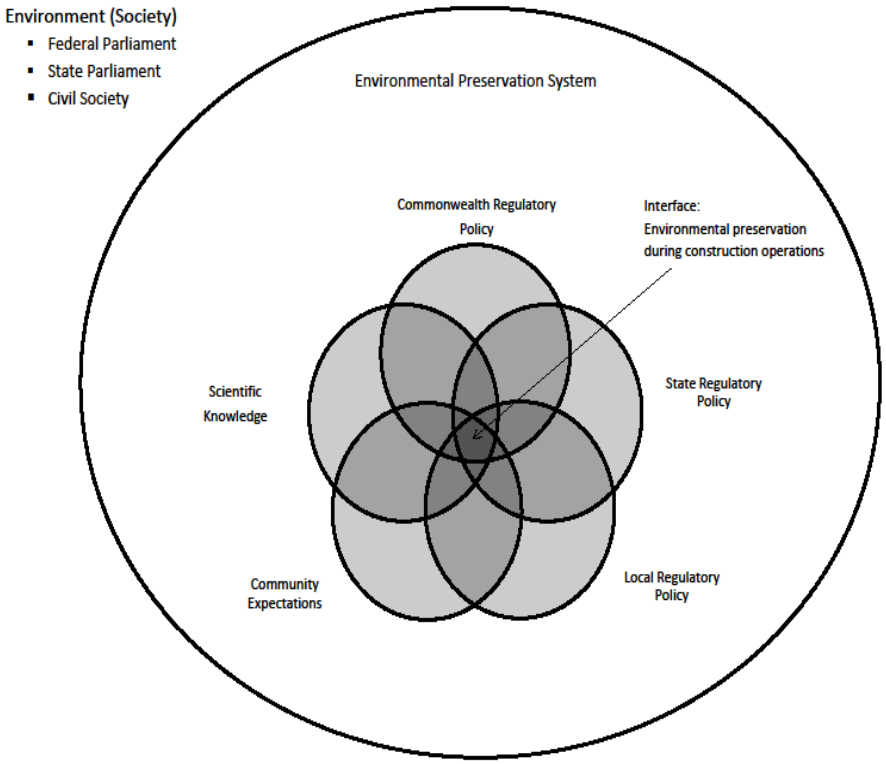

Figure 1, The environmental preservation system

3.1 The Regulatory Dilemma

The effectiveness of regulatory policy in environmental preservation has continued to be the centre of much debate. Kneese (1976) in his review of United States natural resource policy explained that 'It is inconsistent, often outdated, and grossly over dependent on direct regulation…' (p. 253) in addition '…policy also fails to recognize the tight interdependences among all resource problems, including those of environmental resources' (p. 253).

This view continues to be supported as Gunningham and Sinclair (1998) explained '…most existing approaches to regulation, are seriously sub-optimal…they are not effective in delivering their purported policy goals, or efficient, in doing so at least cost, nor do they perform well in terms of other criteria such as equity or political acceptability' (p. 1).

The efficacy of the environmental planning regulatory system within New South Wales has continued to evoke discussion as to whether it is able to achieve ESD. The existing

regulatory system is deemed so multifaceted and complex that the State Government identified a need to '…eliminate unnecessary and complicated red tape', and stated that the system is '…a confusing web of conflicting plans and instruments' (NSW Government, Department of Planning [DoP], 2005a; 2005b). Even after much review and amendment the State Government acknowledged the system '…remains lengthy, complex and confusing…', (DoP, 2007, p.3) and '…that the community generally feels disconnected with the planning process, deeply cynical about whether it is worthwhile to engage, and extremely frustrated about the current system' (NSW Environmental Defender's Office and Total Environment Centre, 2010, p. 3).

During 2011, the State opposition Government was elected into office where one of their first priorities was to undertake a New South Wales Planning System Review around the *Environmental Planning and Assessment Act* (EP&A Act), 1979, the primary document that governs development processes within NSW. An initial Issues Paper released in 2011 identified that considerable components of the Act remain outdated. The Act used '…overly legalistic language…' and '…overly complicated processes…' (DPI, 2011, p. 17) and contained complex provisions that interpretation and assessment practices were abstruse (DPI, 2011).

Regulatory policy appears to have a chequered history in its effectiveness and ability to achieve environmental preservation. It is proposed that this research will use a systems theory approach to investigate construction environmental management controls. What appears to be a main flaw of existing legislation is the inability to review the system as a whole. Any change to the system must be reviewed in a wholistic manner. All the interrelationships and subsequent implications must be given due consideration. This includes the stakeholder element: importantly the often neglected regulators. It is necessary to develop a theoretical framework to demonstrate how government regulations influence on-site operations in the context of examining the entire system. It is proposed that the existing regulatory system will be reviewed using systems theory to identify critical points of departure from achieving ESD.

3.2 The Regulatory System

To enable an examination of the policy system that regulates on-site construction environmental management practices it becomes necessary to first review the hierarchy of influences affecting that system. Within NSW the environmental and planning regulations that govern the construction sector may be conceptualised into a hierarchy of four tiers (see figure 2). Tier 1 and Tier 2 concern the intent conventions. Within Tier 1 these are represented as environmental constructs: principles and standards associated with environmental preservation. Tier 2 progresses upon these expectations though the introduction of mechanisms that propose to achieve standards: environment planning regulations. Tier 3 and Tier 4 are actual conventions associated with operational outcomes: the interpretation and implementation of the regulations. Tier 3 may be considered to have significant influence within the system. The human element is associated not only with the formulation of rules and project design but also with the interpretation and enforcement of those rules and on-site operations. The subjective interpretation and implementation processes associated with regulatory policy may fundamentally alter project outcomes. Systems theory in this research context will

review law interpretation and implementation and its potential to impact upon on-site construction practices.

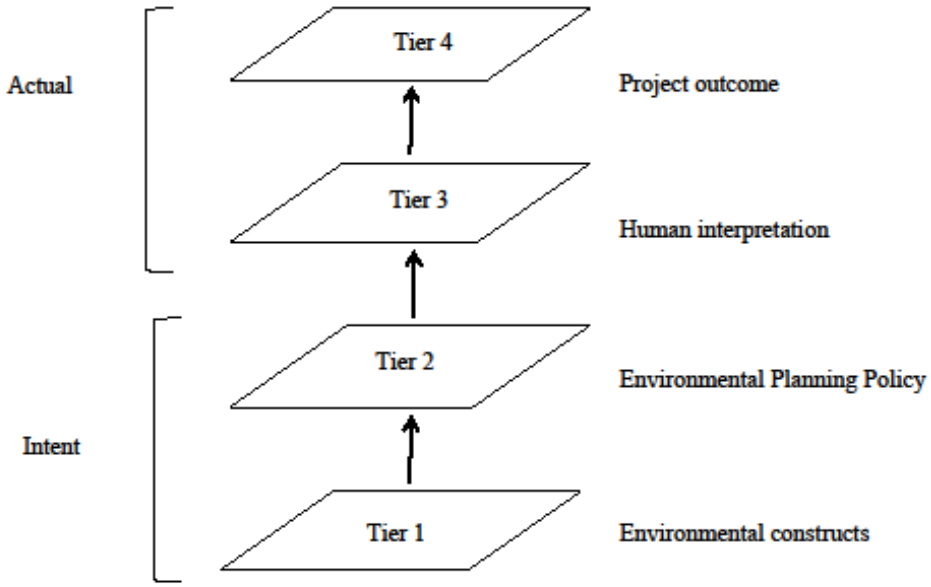

Figure 2, Conceptualisation of legislative-construction hierarchy

From the legislative-construction hierarchy it is possible to conceptualise the environmental preservation system further into elements and relationships. As can be seen in figure 3 the Environmental Preservation System consists of a range of inputs that considers all tiers of regulatory policy, scientific knowledge to stakeholder and community requirements: all elements within the system. Each of these inputs creates the need or desire for regulation and through subjective interpretation would consider regulatory control in different ways. The systems approach will be used to determine interaction of regulatory mechanisms, government agencies and construction stakeholders.

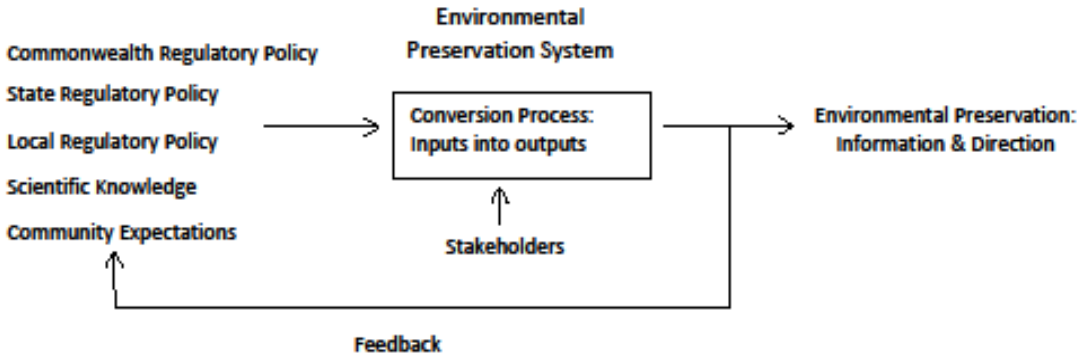

Figure 3, Interactions within the environmental preservation system

At the Federal level directives for many State regulations are established. In the same way many State regulations create the foundation for local level policy formulation. Therefore, all three tiers of regulatory control require consideration as part of the environmental preservation system. Scientific knowledge is a dimension that may demonstrate significant influence. New knowledge initiates innovative technologies and may also alter work place practices where policy must be amended or updated. Advances in knowledge often instigate changes to community perception. Communities have expectations about what environmental preservation should be and how operations should be conducted. Regulatory policy is also directed by the political view: community pressure for change or amendment. Topics of importance or a notable problem to the community are raised at a political level from which existing regulatory policy may be reviewed and possibly amended. This is a typical illustration of system connectivity and why elements, their interrelationships and subsequent consequences must all be given due consideration to enable a complete understanding of the environmental preservation system.

The impact of stakeholders cannot be underestimated. In many respects these include the developers, builders, subcontractors and other technical professionals related to construction processes. The community also forms part of the stakeholder group as their opinions, expectations and desires about proposed development may have a significant influence over the focus and outcome of a project. Within the assemblage of stakeholders, one group is often not given due consideration as an element within the system themselves: the regulators being the policy-makers, implementers and enforcers. These stakeholders are often not given due consideration in the formulation of policy; yet, they have the potential to significantly impact upon a development project.

All the variables discussed contribute to the assemblage of system inputs where the conversion process occurs: inputs are transformed into outputs. The outputs proposed relate to environmental preservation through information and direction on how to address issues raised. As the expected level of environmental preservation is not achieved one element or more are reviewed and the cycle continues to evolve.

Figure 3 illustrates a multi-complex system with numerous elements and interrelationships. An effective investigation of any element within the system requires consideration of all variable and relationships in operation. In order to understand the complexity at the interface of society and statute control, need to take a systemic view of the problem to assist deconstruct all the inputs and outputs. For this research, it is proposed that the systems theory approach: applied through the environmental preservation system will enable the foundation of a framework that will enable an effective investigation into on-site construction management operations.

4 Systems: Theory and Policy

The environmental preservation system is flexible and dynamic, consisting of many dimensions where change occurs according to energy inputs into the system. In general in its current application it may be considered a reactionary system, as an issue is raised there is an attempt to address the dilemma. This process is generally unsuccessful as it neglects consideration of the entire system and importantly interrelationships and

subsequent consequences. There remains a feedback process whereby there is an attempt to address previous issues or a new issue that has evolved. Systems theory provides a mechanism to investigate output of policy change in a holistic manner compared to what appears to be the current ad hoc method of assessing and making change to a single system element in isolation of its counterparts. Research will use systems theory to investigate the regulatory framework and the subsequent impact of stakeholders on that structure in achieving ESD.

Systems theory has potential to result in improved understanding of on-site environmental preservation as Stewart and Ayres have identified that 'Problems such as ecological deterioration, pollution…have been cited as examples of problems which citizens expect governments to act upon, but which are difficult to tackle within normal policy modes' (Stewart and Ayres, 2001, p82.).

Systems theory applies to the research as it would provide a way of reviewing regulatory policy interactions within on-site construction management and potentially highlighting areas where current policy achieves desired outcomes or remains inadequate. The theory encapsulates interdependencies, in this case regulatory policy and enforcement processes and their relationship with construction operations within the environmental preservation system. Importantly, it acknowledges that the system comprises various stakeholders both regulatory and non-regulatory. Although the research focus is with legislation, it will examine the impact of this regulatory policy on private organisations to determine how it impacts upon their ability to achieve ESD. Ultimately the environmental outcome for a given project will reside at the interface of all interactions of the system. It can be seen that the environmental outcome is ultimately the product of complex system interactions.

4.1 Defining Systems

A preliminary step in systems theory is defining the system of concern. Once the system is identified a framework can be developed to enable review of the elements and analysis of their interactions. According to Alexander (1956) a system is '…a group of elements, either physical or non-physical in nature, that exhibit a set of interrelations among themselves and interact together toward one or more goals, objectives or ends'. The definition is in tandem with that of Burch, Strater and Grudnitski (1983) who define as system as '…any set of objects and ideas, and their interrelationships which are ordered to a common goal or purpose'. A system is therefore, a set of interactions amongst entities or elements that have a direct result of achieving a set objective (FitzGerald, FitzGerald and Stallings, 1981, Smith, 1992).

The elements of any system may be defined as physical items or those that are intangible (Alexander, 1956). The framework of a system moves beyond the interactions of tangible entities or elements to what may be considered a subsystem of interrelated structures, concepts and strategies (Smith, 1982). These may present as organisational or managing structures (Alexander, 1956). Remington, Zolin and Turner (2009) define complex systems as demonstrating characteristics that make it difficult to predict outcomes. In essence, any system, regardless of its complexity, may constitute both material elements in conjunction with an array of intangible elements that work concurrently.

In the application of regulatory policy-making, a system 'is often used to describe the assembly of organisations to be found in a given policy field, and to suggest the interconnections between them…' (Stewart and Ayres, 2001, p. 82). To develop an understanding of a regulatory system that maintains a governing role over an area of operation, identification of each element is necessitated to enable determination of the interactions and critical points that affect ability of that regulation to achieve the desired outcomes. According to Mbiti, Blismas, Wakefield and Lombardo (2011) systems thinking considers the dynamics of a system through feedback control of the system itself. In this way a review of regulation related to on-site construction management would consider how the regulation and other system components affect policy effectiveness. Understanding systems provides the theoretical framework by which the effectiveness of any regulatory system can be explored. In this research the elements of the environmental preservation system must be identified. Elements are both tangible concerning regulatory policy and scientific knowledge through to those that are intangible relating to the subjective nature of policy interpretation and the more personal based interactions. Once the system is defined, systems theory can progress to understanding interactions to highlight efficiencies and potential areas for improvement.

4.2 Systems Theory

Smith (1982) and Stewart and Ayres (2001) state that to examine system operations and instigate change it is paramount that an examination of the whole system and all relationships be undertaken, rather than an ad hoc review of components in isolation. Systems theory has been defined as '…a unifying theory that seeks to identify relations and interdependencies among the elements of a system' (Alexander, 1956, p.14). This theory asserts that to understand the effectiveness of a system, its interactions and interdependencies and their impacts upon the desired outcome, an examination of the whole system is warranted. According to Mbiti et al. (2011) sub-entities exist in the construction industry to provide constructed space.

There are many benefits to a systems approach as it allows consideration of broader issues rather than investigating one or a couple of elements of a system. Only where the entire system is examined as one entity, including internal and external impacts, will a complete understanding be forthcoming (Smith, 1982). In effect, an attempt to improve a system by examining all elements and their interactions is likely to be more effective when compared to change of various components in isolation.

Smith (1982) explains that systems approaches may be considered 'divergent and flexible' (p.4) in his view of system analysis and mechanisms for approaching problem resolution. Importantly, within the systems approach the human element is identified and considered within the system. There is a need to not only recognise existence of this system 'element' but understand the significant influence humans have upon anticipated outcomes. In addition, it enables regulatory bodies: policy-makers and enforcers to become part of the system and their impacts upon operations measured.

Sub-entities in the construction industry form a system (the construction industry itself) and as such systems theory can be used to analyse interactions and critical points in regulation of the industry (Mbiti et al., 2011). Systems theory provides opportunity to describe and research the environmental preservation system in a wholistic way.

Tangible and intangible elements, the objective and subjective system influences, in conjunction with the human dimension, may be given due consideration to enable examination of system improvements through the proposed research.

4.3 Systems Theory and Policy Research

Within the literature it has been highlighted that a common result of public policy is its inability to achieve set goals and the creation of sometimes unforeseen negative consequences. There may be many reasons why policy fails to achieve its set goals; however, a main pretext concerns an inability to consider the whole system, all the related components or elements and their relationships (Stewart and Ayres, 2001).

Within the environmental preservation system there are multiple factors that may not be given due consideration in the formulation, implementation and analysis of regulatory policy. Stewart and Ayres (2001) identify a number of variables that contribute to policy failure including structure and processes, political imperatives, communication linkages for implementation, causes and consequences in addition to policy-makers not considering themselves part of the system. These variables are of relevance to this research and the intended outcome from investigating regulation, enforcement and information flow via the systems theory approach:

- Structures and operations
  The structures that govern policy are often the factors that inhibit policy success. In effect, it is the bureaucratic processes that limit policy and silo situations may evolve. Various government departments each focus upon their own component of the system or regulatory policy in isolation and within due consideration of the relationships or consequences.
- The political environment
  Regulatory policy is in effect a policy that has been adopted by Parliament. Parliament introduces political sway into the regulatory scheme. Regardless of the intent such as achieving environmental preservation, there is potential for political motivation to drive policy content and adoption. This may not always be the most suitable for achieving the intended outcome.
- Communication and information flow
  The silo approach automatically induces negative information flow within a system meaning policy has little chance of being successful. Communication channels are needed between those responsible for policy formulation, its implementation and enforcement. It is necessary to ensure that policy is feasible on a practical and economic level so that it may be implemented and regulated. Appropriate information flow may assist to reduce ambiguity and misinterpretation in application of regulatory policy.
- Consequences
  In development of policy it has been identified that insufficient consideration is often given to consequences. Implementation of new policy and amendment of existing policy have interactions within the system and affect outcomes. Typically, this relates to the silo effect where organisations working to an individual agenda have little success of achieving their desired outcome due to limited consideration of associated system variables such as affiliated organisations.

- Stakeholder inclusion
  The role of the policy maker, regulator and enforcer within the system is often overlooked. As stated by Stewart and Ayres (2001) 'they are themselves within and subject to the very system they seek to understand and influence' (p. 80). Consideration of these external non-contractual influences when examining a system is essential to ensure policy success.

Typically, where policy is formulated on the pretence that behavioural change will achieve a policy goal the ability for success is limited. As discussed, compliance is commonly used in policy to achieve outcomes. Stewart and Ayres (2001) describe this process as 'public policies aim to change behaviour target groups by changing key aspects of their environment…' (p. 84). For example, taxes should have an end result of reduced usage of a particular resource or material. There are various concerns with this view as the ability to drive change through this mechanism relates to a variety of factors, primarily project economics. Such factors may not always influence behavioural change as the costs of changing operations associated with the tax are not necessarily feasible for an organisation. Systems theory would enable a review of compliance coupled with system interactions and other policy options to highlight barriers and enablers to an effective environmental preservation system.

Stewart and Ayres (2001) explain that 'systems approaches can also be usefully employed as a way of generating distinctive analytical and implementation strategies from which policy-makers can fashion policy recommendations. More broadly, the systems approach offers policy-makers a fresh set of perspectives on the fundamentals of policy analysis. It suggests that policy design is as much a matter of choosing structures and relationships, as choosing instruments' (p. 91). Systems theory applied to the research would provide opportunity for innovation in looking at the system wholistically to find an efficient combination of elements. Remington, Zolin and Turner (2009) found severity of complexity of a system correspond with context and clarity. It is proposed that a systems theory approach would enable identification of areas in which the regulatory system is not achieving effective on-site environmental management.

Given an understanding of issues that have an impact upon the success of policy we can look at systems theory to provide a framework to better analyse the complex and dynamic environmental preservation system. Alexander (1956) states '…one of the benefits of the application of systems theory to management thought may be to resolve some of the conflicts that presently beset it by stressing the harmonious, integrative aspects of the management function' (p. 14). Although the comment relates to management processes, it remains applicable to the policy domain. As shown there are many reasons behind policy failure, many of which relate to fragmentation of the existing system from structures and process, poor information flow through to inappropriate consideration of causes and consequences. Systems theory offers the opportunity to establish a framework to consider all variables within the system and examine the disconnect between policy intent and actuality. It presents a means by which policy and its desired outcomes can be effectively analysed and assessed. The systems theory approach would assist in identifying key elements, interdependencies and opportunity for improved policy.

Traditional policy formulation involves identification of an issue for which regulation is necessitated, adopting a standard instrument or amending an existing one as applicable to that problem. This appears to be a linear process involving the identification of an issue and resolution mechanism in isolation of any other component of the system in which it operates. Systems theory mandates consideration of the whole system to understand the complexity of any problem. Consideration must be given to the entire system, *inter alia*, regulatory policy, stakeholders and information flow if policy is to succeed. For a policy area in crisis it is neither practical nor feasible to modify one component of the system and expect complete resolution (Stewart and Ayres, 2001). For example, within the environmental preservation system consideration must be given to all stakeholders: developers, builders, community but also the often neglected regulators who have the potential to significantly impact upon project outcomes. In this way a systems theory approach to analysing regulatory policy would consider inputs and outputs of policy.

Systems theory enables the policy maker to look at the system as a whole. This means consideration of all components of the system, considering variables that have the ability to influence change, consider cross boundary communication pathways, consideration of all stakeholders with a contractual or non-contractual influence and consequences of decisions, particularly to other areas within the system.

Application of systems theory to the research would allow for investigation of key aspects of policies and interactions with stakeholders. Systems theory would highlight areas where policy is effective or ineffective and allow for policy shift to target those areas in a way that would enhance systems functioning and thereby result in improved environmental preservation.

5 Conclusion

Construction activities cause environmental degradation. There is a lack of research linking on-site environmental construction practices and environmental management to the effectiveness of regulatory policy, enforcement and information flow. Ultimately there is a disconnect between intent and actuality associated with environmental protection. This research provides context for development of a theoretical framework within which examination of the on-site construction domain can be gauged against existing regulatory controls. In particular it allows development of knowledge about external non-contractual influences on project information flows and their environmental consequences.

With potential disconnect between regulatory policy, enforcement and information flow the research proposes to investigate these variables within the NSW context, to ascertain whether they achieve environmental preservation. Disconnect within interdependencies would be investigated using systems theory to highlight effective and ineffective dependencies and critical points where objectives may be met or skewed.

Application of systems theory in the research would present opportunity to understand all elements of the system and seek areas for system-wide transformation to improve environmental preservation. The large number of existing policies, stakeholders and

interrelationships in the highly complicated system of development and construction management requires a systematic approach of investigation. A systems approach would allow an examination that would improve understanding of the regulatory system and allow for change in the development system with key interrelations identified and areas for potential change highlighted.

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A CONCEPTUAL BIM ACCEPTANCE MODEL IN CONSTRUCTION ORGANIZATIONS: A LITERATURE REVIEW

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ABSTRACT

Substantial research over the past several years has been performed on the data standards and exchange in the AEC/FM industry. The growing popularity of BIM is based heavily upon a perception that the technology can facilitate the sharing and reuse of information during a life-cycle. Therefore, we propose the conceptual BIM acceptance model for understanding why people accept or reject BIM. The objective is to understand the key factors affecting the acceptance of BIM in construction organizations. The external and internal variables identified through a literature review with respect to understanding the acceptance of new information technologies, and then to select external variables to increase BIM acceptance. The proposed model combines the TAM (Davis, 1989), the TTF (Goodhue and Thompson, 1995) and the motivation model (Deci and Ryan, 2000). The model consists of twenty-three factors that are hypothesized to have direct or indirect effects on BIM acceptance. The primary contribution of this paper is to propose the foundation of research on the BIM challenge in the construction as a guide for future research.

Keywords: Building Information Modelling (BIM), Construction Organization, Motivation Model, Task-Technology Fit (TTF), Technology Acceptance Model (TAM),

INTRODUCTION

In 2004, according to a NIST report, the capital facilities construction industry wastes $15.8 billion annually due to interoperability inefficiencies. These inefficiencies include the re-entry and re-creation of information and data, and a duplication of business functions (Newton 2004). Using Building Information Modelling (BIM), these inefficiencies can be solved (Mendez 2006). BIM is “a new approach to design, construction, and facilities management, in which a digital representation of the building process [is used] to facilitate the exchange and interoperability of

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information in digital format (Eastman, et al. 2008)". In the construction industry, there is a growing interest in the use of BIM for coordinated, consistent, and computable building information/knowledge management from design to construction to maintenance and the operation stages of a building's lifecycle.

Although many researcher and practitioner are in agreement about BIM's potential applicability and benefits in construction, it is still unclear how BIM could be used, and what the benefits are to implementing BIM. Thus, BIM adoption and use remains a central concern of BIM research and practice. One of the key measures of implementation success is achieving the intended level of usage of the Information Technology (IT). The IT usage is a reflection of the acceptance of the technology by users (Venkatesh 1999). There is a growing body of academic research examining the determinants of information technology acceptance and utilization among users (Patrick and Paul 2002; Taylor and Todd 1995). In particular, the Technology Acceptance Model (TAM) (Davis 1989; Davis, et al. 1989) has served as a basis for previous research in dealing with behavioural intentions and usage of IT. The previous research argued in favour of investigating antecedent variables that can explain the core TAM variables and extend TAM in a way that enhances our ability to better understand the acceptance and usage of existing and new IT. Factors contributing to the acceptance of an IT are likely to vary with the technology, target users, and context (Moon and Kim 2001). Most of the prior studies have been carried out in traditional and relatively simple but important environments, such as personal computing, e-mail systems, word processing and spread sheet software (Hong and Thong 2001). The technology assessment theories provide a sound theoretical base for examining the factors influencing the use of BIM for construction organizations. Constructs for use in this study are based on those discussed in these theories. Theses constructs were selectively used based on their relevance in the BIM context as evidenced by previous surveys and case studies on the use of BIM.

Therefore, we review acceptance behaviour related theories to propose the conceptual BIM acceptance model within a real business environment by considering it in the implementation of BIM. Namely, the goal of the present research is to identify the additional key determinants of TAM's perceived usefulness and usage intention constructs for a more systemic and integrative perspective of BIM. The primary contribution of this paper is to propose the foundation of research on the BIM challenge as a guide for future research

ACCEPTANCE BEHAVIOR RELATED THEORIES

Technology Acceptance Model (TAM)

The goal of TAM is to provide an explanation of the determinants of computer acceptance that is capable of explaining user behaviour across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified. In this model, perceived usefulness and perceived ease of use are of primary relevance for IS acceptance behaviour. TAM proposes that external variables indirectly affect attitude toward use, which finally leads to actual system use by influencing perceived usefulness and perceived ease of use. TAM assumes that the effects of external variables (e.g., system characteristics, development process, training) on intention to use are mediated by perceived usefulness and perceived ease of use. Paul, et al.(2003) note that there is no clear pattern with respect to the choice of the external variables considered. Actually, external variables provide a better understanding of what influences perceived

usefulness and perceived ease of use, and the presence of external variables guides the actions required to influence a greater use.

Task-Technology Fit (TTF)

TTF matches the capabilities of a technology to the demands of the task. The availability of IT to support a task is expressed by the formal construct known as TTF, which implies matching of the capabilities of the technology to the demands of the task (Goodhue and Thompson 1995). TTF posits that IT will be used if, and only if, the functions available to the user support (fit) the activities of the user. Rational, experienced users will choose those tools and methods that enable them to complete the task with the greatest net benefit. Information technology that does not offer sufficient advantage will not be used. TTF models have four key constructs: the first two are task characteristics, technology characteristics, which together affect the third construct task-technology fit, which in turn affects the final construct outcome variable, either performance or utilization.

Motivation Model

Motivation is a key factor determining human behaviour and action (Lin 2007). An unmotivated person feels no impetus or inspiration to act, whereas when he/she is engaged in some activities toward an end, he/she is considered motivated. Some researchers suggest that individuals may have different amounts, as well as different types of orientations of motivation (Deci 1975). Two broad classes of motivation - extrinsic and intrinsic - have been defined and examined across various contexts and studies. Extrinsic motivation focuses on the goal-driven reasons, e.g. rewards or benefits earned when performing an activity (Deci 1985), while intrinsic motivation indicates the pleasure and inherent satisfaction derived from a specific activity (Deci 1975). Together, extrinsic and intrinsic motivation influence individual intentions regarding an activity as well as a person's actual behaviours (Moon and Kim 2001; Davis, et al. 1992).

THE PROPOSED BIM ACCEPTANCE MODEL

BIM acceptance of construction organizations

The construction industry has several unique characteristics that distinguish it from other industries. Also, the construction industry consists of various organizations (design, contractor, engineer, and facility manager). Therefore, it is necessary to describe the nature of the organizations in order to understand the problems that may influence the acceptance of BIM use by the construction organizations. BIM is being developed with a broad range of users in mind. As such, its uses are extremely varied and in many cases can differ significantly among build team members. A list of the potential uses is as follows:

- 3D visualization (architecture/structure/MEP)
- Clash detection
- Feasibility studies
- Model based quantity take off and estimating
- Visualized scheduling (4D) management
- Environmental analysis or LEED certification
- Creation of shop drawings and schedule management for installation
- Visualized constructability review
- Visual and geospatial coordination for construction of atypical shape
- Creation of as-built model for facility management

The acceptance of BIM means that construction organizations use BIM application for their task. As a highly collaborative and data-rich environment, BIM has the inherent capability to reduce costs and promote efficiencies. To successfully accept BIM in construction, effective collaboration and clear role sharing for modelling among users are necessary. Then, all users should comply with the standardized policies and procedures for modelling.

Overview of proposed model

The proposed conceptual model is constructed by integrating three empirically tested and proven research models such as TAM, TTF, and motivation model. The model provides the rationale for the variables based on theoretical backgrounds on TAM, TTF and motivation model, and incorporates additional variables based on literature on BIM use. Based on the above concepts, a research model for BIM acceptance is proposed (see Figure 1).

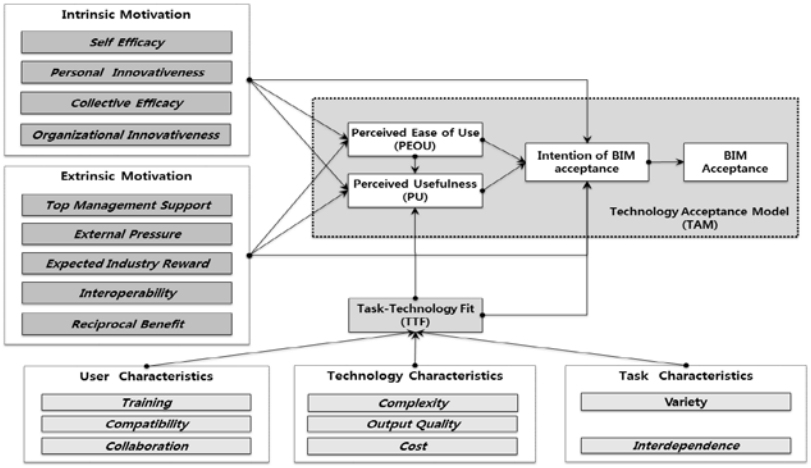

Figure 1 The conceptual model

External Variable for BIM Acceptance

In general, the result of user acceptance of information systems in the mandatory environment differs depending on external variables. Studying the external variables for BIM not only contributes to theory development, but also leads to improved BIM acceptance. As shown in figure 1, the components used to accept BIM in construction organization are 1) user related factors-individual and organization, and 2) technology related factors.

1) User related factors

First, although BIM acceptance is in the mandatory environment, the confidence that user can successfully utilize BIM is necessary to accept BIM, and the suitability of the potential adopter's work environment should be considered. Also, because effective collaboration and clear role sharing for modelling among construction organizations are necessary, unlike most system acceptance, organization factors should be considered for successful acceptance of BIM in construction organizations.

Self-Efficacy: The concept of self-efficacy originates from social cognitive theory (Bandura 1977). It refers to the conviction that one can successfully execute the behavior required to produce the outcome. Self-efficacy is used as perceived behavioral control, which means the perception of the ease or difficulty of the particular behavior. It is linked to control beliefs, which refer to beliefs about the presence of factors that may facilitate or impede performance of the behavior. ***Personal Innovativeness:*** Personal innovativeness is defined as "the willingness of an

individual to try out any new information technology". According to Agarwal and Prasad (1988), personal innovativeness helps identify individuals who are likely to adopt information technology innovations earlier than others. Learning a person's individual innovativeness would help us to further understand both how perceptions are formed and the subsequent role they play in the formation of individual behavior. ***Compatibility:*** Compatibility, defined as the degree to which the technology fits the potential adopter's previous experience, work practice, and needs, has been identified as an essential factor for innovation adoption (Moore and Benbasat 1991). Considerable prior research has reported a significant effect of compatibility on the user technology acceptance decision. ***Training:*** Training is a primary factor affecting the adaptation of a new technology within an organization because it helps users to understand how to best use and adopt BIM applications (Peansupap and Walker 2005). Without appropriate training, most technology users take time to learn and utilize only some capabilities of the technology. The level and type of training should ideally be based on the tasks to be performed by different departments or persons within an organization. Training was therefore used as a factor in this study. ***Variety:*** Task variety is the degree to which one has to conduct exceptions or a wide range of operations (Morgeson and Humphrey 2006; Sims, et al. 1976), and therefore different methods or procedures are needed for conducting the work (Van de Ven and Delbecq 1974). It is also referred to as the stability, rigidity, or repetitiveness. ***Interdependence:*** Task interdependence is the degree to which completing tasks requires interaction with other people (Liden, et al. 1997). Task interdependence consists of two types (Kiggundu 1991): initiated and received interdependence. When someone is dependent on the work of others, it is referred to as received task interdependence. In cases where someone affects the workflow of others, it is referred to as initiated task interdependence. It is all together the degree of 'interconnectedness' between jobs(Morgeson and Humphrey 2006), in which the success of one depends on the performance of others (Kiggundu 1981;1983).

Collective Efficacy: This concept refers to the organizational dimension to inquire about efficacy beliefs in organizations. Inquiry into collective efficacy beliefs emphasizes that teachers have not only self-referent efficacy perceptions but also beliefs about the conjoint capability of users. Such group referent perceptions reflect an emergent organizational property known as perceived collective efficacy (Goddard, et al. 2000; Hoy, et al. 2002). ***Organizational Innovativeness:*** We defined that organizational innovativeness as "the willingness of an organization to try out any new information technology". To successfully accept BIM, effective collaboration and clear role sharing for modelling among construction organizations are necessary. Then, all construction organizations should comply with the standardized policies and procedures for modelling. Therefore, personal innovativeness as well as organizational innovativeness should be considered. ***Top Management Support:*** Top management support has extensively been recognized as an important variable in technology implementation studies (Gilligan and Kunz 2007). The decision by an organization to adopt BIM may by a risky decision for the organization unless there is a firm commitment from top management. Gillgan and Kunz (2007) found that top management commitment was one of the major success factors for adopting BIM technologies. It is anticipated that firms that have significant top management support for adoption for BIM are more likely to it. ***External Pressure:*** External pressure involves the influences arising from several sources within the competitive environment surrounding the organization. Enacted user power measures the strength

of the influence strategy (e.g., rewards and threats) used to exercise that potential power.

Expected Industry Reward: Industry rewards can range from monetary incentives such as increased benefit and market share. Thus, this study expects that if organizations believe they can receive industry rewards by using BIM, they will develop more positive attitudes toward and intentions regarding the use of BIM.

2) Technology related factors

Second, unlike other technology acceptance, BIM can only be utilized in a data-rich environment. Thus, the quality of information which is included in BIM is a key factor affecting the acceptance of BIM. Also, to improve the information quality of BIM, the barriers of BIM acceptance should be solved, and an environment of collaboration among users in design and construction should be created.

Cost: Rogers(1983) noted that the less expensive an innovation is, the more likely it is to be adopted. The cost of an innovation includes the initial investment cost as well as the operations and training costs that facilitate effective use of the technology (Premkumar 1995). In previous technology assessment research, cost has been suggested as a major barrier to widespread adoption of innovative technologies (Premkumar 1995). Related research on BIM adoption has also shown that cost of BIM technology is a major factor (Gilligan and Kunz 2007; Timo and Martin 2008; Kunz and Fisher 2007). It is anticipated that firms that perceive BIM technology to be relatively less costly are more likely to adopt it. ***Complexity:*** Rogers(1983) defines the complexity of an innovation as "the degree to which the innovation is perceived as relatively difficult to understand and use" observed that although an innovation may appear to be useful, the organization may find it complex to use. They concluded that since complexity of an innovation functions as an inhibitor to adoption, it is usually negatively related to adaptation. Other researchers have also shown empirically that technology complexity is an important factor that influences technology adoption.

Output Quality: In the construction industry there is a growing interest in the use of BIM in construction for coordinated, consistent, and computable building information/knowledge management. The information collected through a BIM process and stored in a BIM compliant database could be beneficial for a variety of construction practices. Therefore, output quality of BIM is measured by capability of search, accessibility and trust of information. ***Collaboration:*** In construction industry, good communication between various organizations such as design, contractor, engineer, and facility manager is key factor to archive project success. However, East and Brodt(2007) presented several problems with communication between construction organizations. To solve these problems, the role, responsibility and workflow for loading data into the model should be clearly defined and also a legal framework for integrating owners' view in design and construction should be sufficient. ***Interoperability:*** Interoperability can be defined as software compatibility. If refers to the ability to seamlessly exchange data between different BIM applications (Eastman, et al. 2008). Several case studies have pointed out the importance of interoperability between different BIM applications that are used by project participants in order to drive the adoption and use of BIM technology (Fox and Hietanen 2007; Timo and Martin 2008; Kandanala 2005; Kymmell 2008; McFarland 2007; Staub and Khanzode 2007). It is anticipated that issues relating to interoperability influence the level of BIM in construction. ***Reciprocal Benefit:*** The social exchange theory assumes that people try to maintain a balanced relationship in

terms of resource exchange, which is known as the norm of reciprocity(Gouldner 1964). According to the social exchange theory, participants in a virtual community expects mutual reciprocity that can justify time or efforts spent to raise their knowledge (Thibaut and Kelly 1959). Davenport and Prusak(1998) pointed out that reciprocity is one of factors leading sharing of knowledge, and Kankanhalli, et al.(2005) found that under conditions of weakly shared norms, there is a positive impact on the use of electronic knowledge storage by knowledge sharers. These provide a sufficient possibility in forecasting that reciprocity will influence the use of the BIM.

DISSCUSION AND LIMITATION

Substantial research over the past several years has been performed on the data standards and exchange in the AEC/FM industry. The growing popularity of BIM is based heavily upon a perception that the technology can facilitate the sharing and reuse of information during a life-cycle.

The objective of this research is to understand the key factors affecting the acceptance of BIM in construction organizations. The proposed model combines TAM (Davis 1992), TTF (Goodhue and Thompson 1995) and the motivation model (Deci and Ryan 1987). The model consists of twenty-three factors that are hypothesized to have direct or indirect effects on BIM acceptance. The twenty-three factors consisted of two broad classes: (a) user related factors (*Individual*: self-efficacy, personal innovativeness, compatibility, training, and variety, *Organization*: collective efficacy, organizational innovativeness, top management support, and external pressure, and expected industry reward) (b) technology related factors (cost, complexity, output quality, collaboration, interoperability, and reciprocal benefit).

In future research, the measurement items for the BIM acceptance model in construction should be examined to ensure reliability and validity within the BIM in the construction context. Also, hypothesis testing for the relationships between the key factors that may lead to the high acceptance of BIM in construction needs to be conducted.

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STRATEGIC AGILITY AND PROGRAMME ORGANISATIONAL STRUCTURE FOR ENERGY EFFICIENCY DELIVERY IN BUILDINGS

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ABSTRACT

Various explanations have been adduced for underachievement in energy efficiency programmes for buildings. Certain quarters in energy efficiency programme management generally agree that energy efficiency governance and hence coordination mechanisms and programme organisational structure are key determinants of outputs. This is not far from the truth taken that organisational studies confirm that strategy and structure greatly influence performance. However, this remains to be investigated in programme management and energy efficiency context. A literature survey and pragmatic approach is taken in analysing the strategy and organisational structure for energy efficiency programmes for buildings run by South Africa's electricity utility giant, Eskom. Applying complex adaptive systems theory, diffusion of innovation theory and behavioral theory of the firm, suggestions are made on adoption of strategically agile programme organisational structures oriented to improve effectiveness of energy efficiency programmes in buildings. The value of the study is hinged on the fact that energy intensive nature of South Africa's economy, current electricity supply stress and significantly high greenhouse gas emissions per capita necessitates greater effectiveness and improved performance for demand side energy efficiency programmes.

Keywords: buildings, energy efficiency, programme organisational structure, strategic agility.

INTRODUCTION

Eskom, South Africa's public electricity utility corporation enjoys monopoly status as the main electricity producer and accounts for 96 % of total production (NERSA, 2001 Republic of South Africa, 2001). Eskom also directly distributes 40% of electricity (Khumalo *et. al.* 2000). South Africa's Electricity supply industry is regulated by the National Electricity Regulation Board of South Africa (NERSA) (Republic of South Africa, 2006). Two main drivers for electricity energy efficiency exist in South Africa; these are the near supply deficit and the high carbon intensity level of electricity industry. Dominant within the policy framework for energy efficiency is Eskom's integrated demand side (IDM) energy efficiency programme. The IDM programme divides initiatives into specific industry focus areas such as

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buildings, agriculture, mining, commercial and industrial sectors. IDM's perspective in buildings include activities in CFL and LED lighting retrofitting, energy efficient water geysers, energy smart farming, energy efficient use of pumps, support for energy service companies (ESCOs) amongst others (Eskom, 2007). Generally, energy efficiency programmes often present a challenge due to the fact that they are temporal yet they function within and lead to consequential long term complex realities. The complex realities within which they function include the fact that programmes are diversified; have high number of stakeholders' involvement, operate within rapidly changing market dynamics and are sometimes affected by rapidly changing legislative framework and monopolised industry structure. Consequential long term realities is inclusive of the fact that regulatory framework introduced to encourage the adoption of energy efficiency practices end up being a permanent fixture. In addition, the programmes may often lead to permanent market transformation. The IDM programmes are no exception and all modes of complexities are interplayed. These complex realities present great challenges and opportunities in organisational research. Given that buildings account for 30-40% of all primary energy use in the world (UNEP, 2007) and that 27% of South Africa's electricity use occurs are building related, makes the focus of this paper of great relevance (Department of Minerals and Energy et al, 2002). Subsequently, South Africa's buildings present a great opportunity to realise electricity demand reduction target set by the national energy accord and an opportunity for reduction in operational costs of facilities.

Electricity energy efficiency demand side management (DSM) programmes have great potential in realisation of energy savings and effecting market transformation (Hansen, 2009). However, debate exists on the performance and cost effectiveness of DSM programmes. Hansen (2009) attributes this to diverse foci and minimalistic scope. Other studies on the under-performance of DSM programmes argue that this is probably due to a combination of high transactional costs, agency related issues, inappropriate management strategies, non-supportive financial infrastructure, ineffective coordination framework among other issues (Sarkar and Singh, 2010; International Energy Agency, 2010; Zhou et. al., 2011). In a roundtable discussion on the issue, Tanaka (2010) singled out energy governance as instrumental in the delivery of DSM programmes. Tanaka (2010) and IEA (2010) conceptualise key components of energy efficiency programme governance as enabling framework, institutional arrangements and coordination mechanisms. The explanations given by Hansen (2009), Sarkar and Singh (2010), IEA (2010) and Tanaka (2010) and Zhou *et. al*., (2011) among others on energy efficiency programme performance may be summarised as related to strategy and organisational structure issues. This leads to the postulation that the 'marginal performance of the DSM programmes may be related to inappropriate or ineffectiveness of applied strategy due and organisational structure'. It is noted that the reported primary energy savings from IDM of 354.1 MW financial year 2011 (Eskom, 2012) is at best marginal and betrays an inability to ensure the targeted 14% electricity demand reduction via energy efficiency by 2014 (DME, 2005). This paper advances the argument that appropriate choice of strategy and programme organisational structure could significantly lead to greater outputs for IDM programme in South Africa.

METHODOLOGY

The paper interrogates the motivations and theoretical underpinning of strategy and programme organisational structure for the delivery of energy efficiency in buildings

by Eskom, in South Africa. The programmes run by Eskom were selected as the focus of this discourse due to the fact that they are the only countrywide programmes in South Africa. In addition, it is the only energy efficiency programme framework funded by NERSA (Eskom, 2011). The current investment by NERSA on energy efficiency under the IDM's framework totals R 5.44 billion for the years 2011-2013 (*ibid*). As such the programmes form the biggest demand side management cluster in South Africa. In addition, the institutional base of IDM makes it ideal for analysis. To achieve its aim the paper largely relies on literature review and information from Eskom's website on IDM framework. The strategy and organisational structure applied in the implementation of IDM programmes in buildings are analysed with intention to suggest possible improvements.

STRATEGY FOR ENERGY EFFEICIENCY PROGRAMMES

Three generations of DSM programmes are distinctly identified by (Faraqui and Fox-Penner, 2011). The first generation emerged in the 1980s as a reaction to the 1970s oil crisis and emphasized cash rebates and low interest rates to manage demand, energy costs and achieve short term gains in primary energy savings (*ibid*). The second generation identified by Faraqui and Fox-Penner (2011) are those which emerged in the 2000s and tend to focus on management of electricity prices through real-time pricing, peak demand management for systems with low reliability and wholesale consumers. Lastly, the third generation DSM programmes are those which centre on increasing customer awareness, interest and engagement; technological innovation; enactment of energy efficiency codes and standards and energy price innovation (Faraqui and Fox-Penner, 2011). Thus, two distinct categories of strategies are observed; these are the ***resource acquisition*** strategies often aimed at short term achievements or low hanging fruits (Rosenberg and Hoefgen, 2009) and the ***market transformation*** strategies which are often geared at permanent change in market behavior (McLean-Conner, 2009). Comments can thus be made to the effect that first and second generation DSM programmes pursued resource acquisition strategies whereas the third generation ones are designed to achieve market transformation. A close observation of the IDM programme portfolio highlights the fact that the activities constituting it are geared towards both resource acquisition and market transformation. Modern concept of strategy revolves around 'strategy fast' and hence strategic agility (Doz and Kosonen, 2008). This entails the use of strategically agile systems organised around the three meta-capabilities of strategic sensitivity, leadership unit and resource fluidity and is associated with (Doz and Kosonen, 2010). Pellissier (2011: 152-22) further explains that strategic agility would lead to the use of iterative strategies; emergence focused planning systems, decision making spirals, continuous interactive learning and innovative solutions. Using these observations, four main comments may be made with regards to Eskom's IDM programmes. First, that the programme designs must be continually anticipatory to constantly changing policy and legal environment. This is based on the fact that South Africa's energy efficiency policies are still at infancy stage and are continually changing. Energy efficiency programmes must therefore be able to not only anticipate changes in policy and regulatory framework, but also be adequately prepared to take advantage of the changes. Second, programmes must be reviewed continually to ensure real-time response to the market dynamics. Thus strategies employed could be fine-tuned in line with the energy efficiency programme life cycle to improve outputs and ensure rapid maturity. The fine-tuning of the strategies must take into account the lessons learnt by the organisation in its implementation process. Third, programmes should

ensure experimentation with innovative ideas and technologies that could provide home-grown solutions to the South African energy efficiency agenda. Last, there is need to run lean programmes that ensure operational and transactional costs that are kept at a minimum. In addition, the clientele should not find the adoption of energy efficiency practices in buildings prohibitive. This could be achieved via service integration and partnerships.

A demonstration of strategic agility in the form of 'fast fashion' is ably employed is in fashion industry (Sull and Turconi, 2008). Sull and Turconi (2008) explain that foundations of 'fast fashion' strategy revolves on the satisfaction of ensuring mass sales in the short term and integration of production and distribution in the long term. This can be successfully achieved by ensuring heightened situational awareness in a continually changing environment, ensuring high capital fluidity and outsourcing of non-core and non-sensitive business activities (*ibid*). Energy efficiency programmes in buildings is very much alike to the fashion industry in that in order to be cost effective, programmes must be structured such that adoption of energy efficient practices undergo the full cycle to maturity as fast as possible. Not to be ignored is the idea of outsourcing, as demonstrated in 'fast fashion', capital-intensive and complicated activities may be retained in-house while labour intensive operations get outsourced to proven networks (Sull and Turconi, 2008). This may ensure a nimble programme with improved ability for market based feedback (Doz and Kosonen, 2008). The ability to respond to market dynamics is thus a key determinant in strategy formulation and implementation for faster turnaround. However, this is only possible with sound market intelligence. Energy efficiency programmes must therefore have the ability to detect and effectively respond to market dynamics. This not only calls for an appropriate strategy but also a complementary programme organisational structure.

PROGRAMME ORGANISATIONAL STRUCTURE

Organisational structure can be described as the framework within which labour is divided to improve coordination towards realisation of strategy (Mintzberg, 1979). The programme organisational structure used in IDM implementation oscillates between 'functional structure with horizontal linkages (FSHL) and divisional structure (DS) in nature (Eskom, 2011). The IDM is run as an autonomous department in Eskom. Though anecdotal, it is noted that the current structure may be pervaded by slow response to market dynamics, hierarchical overload, dampened innovation and poor coordination as is symptomatic of FSHL and DS (Daft, 2007). It should be pointed out that programme organisational structure is uniquely guided by clear operational goals and objectives, and are largely temporal in nature. In the case of energy efficiency programmes the key goal is to achieve energy resource acquisition or market transformation (Rosenberg and Hoefgen, 2009; McLean-Conner, 2009). In addition it is observed that in energy programmes strategies are linearly set and only reviewed in cycles of 3-5 years (Rosenberg and Hoefgen, 2009). This is obviously informed by the school of thought advanced by Chandler (1962) and Mintzberg (1979) amongst others. This perspective is however defective in that it fails to effectively deal with complexities and associated emergences in the programmes. The DSM programmes in buildings may therefore be conceived as exhibiting *allopoietic* tendencies. This implies that due to influences in environment and strategy and programme organisational structure design, the programmes are forced to dynamically adapt for realisation of desired performance (Weis, 2008). Complex Adaptive System

tendencies manifest itself in the proposed research mainly as a result of the continually changing regulatory framework and market dynamics for DSM energy efficiency programmes. This implies the necessity of an equally constant changing environment and organisational governance structures. These demand increased activity levels in terms of feedbacks and management of emergences (Newell et. al., 2011).

Key determinants of an organisational structure are communications, coordination, integration and decision making (Daft, 2007; Mintzberg, 1979 and Galbraith, 2002). In particular, Cyert and March (1963) identify decision making process as a key function in the organisational structure and hence a major determinant in strategy-structure-performance construct. This is firmly rooted in behavioural theory of the firm which among other issues postulates that prevailing decisions in an organisation are estimates of decisions from other levels of its operations and the flow of information is determined by organisational structure (Cyert and March, 1963; Sah and Stiglitz, 1988). Thus, level of centralisation or decentralisation of structures determines decision making processes, coordination and communications (Csaszar, 2011). The choice between decentralised or centralised system is determined by the strategic delineation of the organisation, that is whether it is seeking exploitative or explorative agenda (Hill and Birkinshaw, 2008). Exploitative based strategies are often associated with refinement, increase of competency level and predictability or stability whereas explorative based strategies implicate experimentation with alternatives and need for adaptability (March, 1991). It can be conclusively stated that behavioural theory of the firm best explains strategy-structure interrelationship. This is evident from the fact that decision making defines organisational structure, interrelationship with strategy and is significant in coordination (Csaszar, 2010; De Canio, 2000 and Cyert and March, 1963). In addition, Eskom pursues multiple objectives and as such must adopt a structure and strategy that best ensures performance in all the areas of operations as observed by DeCanio (2000). This may include partnerships, outsourcing of services in energy efficiency programmes amongst others. For a temporal programme whose structure is dependent on market growth such as energy efficiency programmes, this may imply reconfigurable structures as advised by Galbraith (2002).

MARKET DYNAMICS

Considering the fact that this interrogation adopts a complexity approach, the influence of market and industry on strategy-structure interrelationship and performance DSM programmes must be considered. It is postulated that marginal performance of DSM energy efficiency programmes run by Eskom for building is related to the prevailing market transactional costs of the energy efficient innovations as a result of use of inappropriate strategy and programme organisational structure. Government intervention may thus be advised to reduce energy efficiency gap (Bhattacharya, 2010) and in terms of creating enabling regulatory framework, increasing disbursement of subsidies and reforming the industry structure to reduce costs associated with adoption of energy efficient technologies for buildings (Eto and Golove, 1996).With regards to the industry structure, the prevailing vertical integration and monopolistic characteristics in South Africa (Eberhard, 2000) could encourage non specialisation and reduced flexibility demanded for successful implementation of the programmes (Newell *et. al*., 2011). This may explain the marginal successes in terms of resultant programme outcomes. It should be further

noted that all energy efficiency programmes follow a generic market life cycle development no matter the category of strategy used in its design. McLean-Conner (2009) identify these stages as introductory, growth and maturity stage, associated unique characteristics and market related barriers and suggest possible application to monitor programme performance . For example during the introductory stage, the market is characterised by limited adoption rate, few channels and non-existent codes with great barriers being related to affordability, accessibility and awareness (*ibid*). On the other hand, the maturity stage betrays support from codes and no market barriers (*ibid*). This school of thought possibly emanates from the diffusion of innovation (Rogers, 2003). Such an indicator would be instrumental in ensuring dynamic market feedback necessary for an equally dynamic organisational restructuring alluded to earlier as the second challenge in applying strategy fast in energy efficiency programme.

CONCLUSION

Faster turnarounds are needed for Eskom's IDM programmes. This could be achieved by adopting strategic agility as the core of energy efficiency programme governance as it would ensure greater dynamism and responsiveness to changes in market situation, programme goals, technology, and clientele response. The study notes that that the full growth of programmes through the life cycle is hampered by poor governance and management that have resulted as a result of ill constructed structures.

RECOMMENDATIONS

For energy efficiency programmes in buildings, a five point agenda is suggested. This include: 1) actualising an open and inclusive strategy process for all stakeholders including building occupants, who are the product end users for technologies such as CFL and LED lighting fittings, 2) improvement in market intelligence to enhance feedback and self-correction capacities in programmes, 3) retrospective and anticipatory approach to programme design for South Africa' s buildings. This may include the ability to anticipate changing policy and legal environment such as recent introduction of SANS204X, SANS104000X, review of energy act among other issues and elimination of the 3-5 years review timeline (Rosenberg and Hoefgen, 2009) firmly rooted in classical linearly approach to management, 4) Lean programmes are needed to ensure greater cost effectiveness and reduce transactional costs of adoption. This could be achieved via service integration and partnerships; thus the local authorities, residents associations, property owners groups may be roped in as partners in programmes, 5) The adoption of a complex adaptive systems approach motivates for the need of self-correcting feedback mechanism. As part of this, the development of a market indicator based diagnostic instruments may help improve on organisational capacity for dynamic response. It is further proposed that field study investigating strategy and programme organisational structure for the case of IDM's programmes' framework be undertaken using documentary review and interviews with stakeholders. This approach is supported by Amitabh and Gupta (2010) who advocate for non-linear investigation of strategy-structure and performance construct for innovative organisational set-ups. The suggested methodological approach is therefore largely leaning towards interpretative and qualitative nature.

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THE USE OF 3D BIM VISUALIZATION TO AID CHILDREN PARTICIPATION

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ABSTRACT:

It is not uncommon in the planning process, for the opinions of community members to go unanswered, in the past ten years the Government has made much progress in ensuring that Community involvement is central to any Regeneration project. However when the opinion of Children are needed this level of involvement may not be efficient and more care will be needed in order to ensure that a child is given adequate support to help encourage a realistic response. This article will discuss the issues relating to the development of a childs play area. Furthermore this paper will identify how the use of a 3D BIM Model was used as a tool to aid the children's understanding, and encourage realistic responses when asked to generate ideas for a new Play Area within their village. This article shows that without the use of 3D visualisations and walkthroughs being presented to the children, they had very little understanding of the scale of an area, and an unrealistic perceptions of what the Park should include. The use of the Visual imagery generated from the 3D BIM Model not only resulted in more achievable suggestions being made by the children, but also resulted in reducing Development costs/quotes as a clearer understanding of what could fit into the area was achieved.

Keywords: 3D BIM, Animation, Visualisation

INTRODUCTION

'As the world gets more crowded, especially in Urban areas, more people are concerned about what happens with their neighbours' property' (Delaney, 2000). The professionals believe that they know best, however in order for a development to be successful and meet the end users requirements there is a need for the public to have a more active role.

There are several key reasons to why the public may want to be involved in developments, these includes; An interest of what is happening in their community, to support or oppose a development, or as a hope to see their area developed in a positive way. Whatever the reason for participation it is nonetheless an important factor to successful developments as it improves decision making, enhances cooperation and ensures that key requirements of those living in, around or using the areas are met.

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However this should not only apply to Adults but also a process that should apply to children as they are the key to future use, and therefore "have a right to a voice in matters that concern them; they are experts on their own environments, well placed to identify the problems that concern them and the solutions that best address these concerns" (ANON, 2002).

According to Flynn (1983) "Children develope their awareness of distance and depth very slowly. Judgment of distance becomes clearer as the child has more experience with actually traversing the distance themselves" (Flynn, 1983)

"From a developmental psychology perspective; the 'middle childhood' stage of 10-12 years is widely considered to be an optimum time for children to develop environmental skills, because this is when children begin to explore their environments independently of adults (Wridt, 2010; de Vries et al., 2007). However, there have been examples where children as young as four successfully participated in spatial planning exercises (Horelli, 1997), whilst Roe's (2006) studied children aged 6–10 years old, illuminating how they understood their environment and boundaries, and how it contributed to their well being. A potential drawback of working with much younger children, however, is that they can sometimes lack a suitable level of knowledge and experience of planning systems to identify options for change" (Day et al., 2011). Therefore the way in which children participate needs to be discussed.

Research carried out by Ecorys (ECOTEC) and Loughborough University showed that "there is evidence from research and practice that children and young people can play a significant role within planning and regeneration processes" (Day et al., 2011), however "children's participation in local planning and development processes has experienced limited development in mainstream decision-making within the UK" (Day et al, 2011).

"The first National Play Strategy (DCSF, 2008) set out a long term vision to realise children's play rights. The Strategy followed the 'Fair Play' consultation, which received a response from 9,400 children and young people, and showed a clear demand for children's participation in the design and planning of local play spaces (Day et al, 2011).

Millar stated that "Outline research shows that children's perception of space is, in certain ways, different to the spatial perception of adults. By determining why these differences are there and how, throughout development, they change, it should be possible to inform design to be more responsive to children" (Miller, 2007).

Millers research into Children's' perception of space concluded that:

• The spatial perceptions of adults and children have differences, not least because the means by which they perceive space are different.

And

• The spatial organisation of buildings appears to have an effect on the spatial comprehension of children. Their ability to understand a building with strong visual links between spaces is much greater than a building based on a logical sequence, of cellular arrangement.

In order to encourage participation within children, Bryson (2009) suggested that 'A Multi-Method' approach should be used as "there is no set way of doing things. Using a range of techniques and approaches will ensure there is something that works for everyone" (Bryson, 2009). Day et al., (2011) suggested that "there have been few

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previous attempts to categorise the range of approaches for supporting children and young people's participation in planning and design". This following section will discuss a study conducted by the author which focused on selecting the best methods to aid children and encourage participation.

SURVEY

In 2007, the author completed her research which investigated the different methods available to display proposed developments at Planning Events in order to enhance public understanding, and increase Participation.

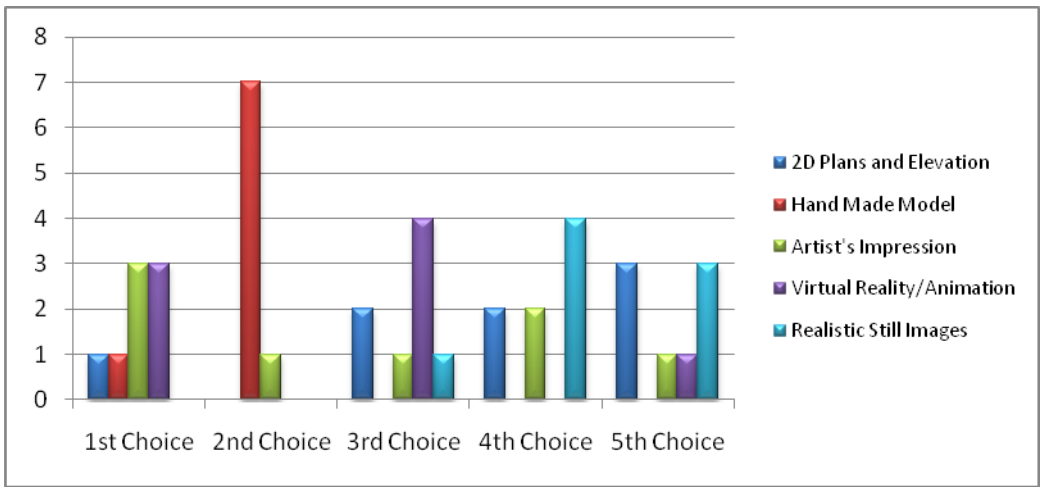
During the Survey Study several techniques for presenting design proposals were displayed for viewing. These Techniques included; 2D Plans and Elevations, A Hand-Made Model, Artist Impressions, Still Images and a Virtual Walkthrough displayed on a Laptop. Each participant were asked to rate which technique they found easiest to understand, and if they would feel more equipped to participate in future planning events if the favoured technique was adopted. The results of the study showed that in order to help members of the public to understand developments they would need to be shown 3D Visualisations, whether as Still Images (Photomontages), or 3D Walkthrough/Animations created from the 3D BIM Model.

This study targeted adults and adult opinion, therefore in order to get a view of how children perceived these techniques, a further study was conducted where only children under the age of 16 were asked to participate

The results of the survey were analysed within two separate age groups (7-11) which represented the Primary School Level, and (12-16) representing Secondary school level.

The Primary Group represented 37% (8) of the respondents, while the remaining 63% (14), were of secondary school age.

The children were asked to walk around the exhibition room and look at the different Presentational Techniques displayed. Once the children had finished they were asked to rank the techniques in order of preference. Graph 1.1 and Graph 1.2 below illustrates these results.



Graph 1.1: Primary School level Results

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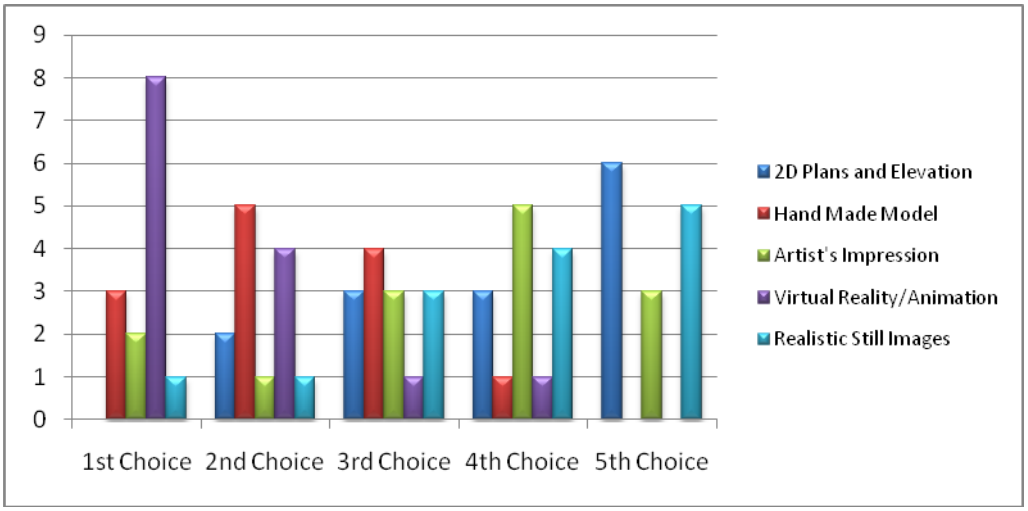

Graph 1. 2: Secondary School level Results

Graph 1.1 illustrated the Primary Groups choices in regards to what they rank as their 1st, 2nd, 3rd, 4th and 5th favourite presentational technique. The graph shows that their favourite choice with 38% (3) was the BIM Animation and the Artists Impressions, this could be due to a child's familiarity with drawing, and playing computer games.

In regards to the Secondary group, they also selected the BIM Animation as their favourite option with 57% (8), their second choice was the Hand Made Model 37% (5) with a further 29% (4) selecting the BIM Animation. The primary group also selected the Hand Made Model as their second most favoured technique with 88% (7)

Both groups listed their least favourite technique as 2D Plans and Elevations (38% (3) Primary and 43% (6) Secondary), and Photo realistic images (38% (3) and 36% (5)) Secondary.

Rybczynski, (2009) stated that "Building bricks were called 'rational' toys, and they were intended to ground children with an early understanding of engineering, gravity and physics" (Cited in Burgess, 2010), this could therefore explain why a Hand Made Model was considered as a second choice.

Analysing the responses from the children shows that once again, the most dominant technique displayed proved to be the BIM Animation. The fifth choice was the 2D Plans and Elevations. This was also reflected in the adult responses in 2007 with 41% of adult responses selecting the BIM Animation as their favourite and only 12% selecting 2D Plans and Elevations.

Today with the ever growing trend of Television Programmes which showcase the use of 3D modelling and Animations, 3D Televisions, Films and Computer Games, it is inevitable that 3D technology will continue to grow, and public demand will also increase. The demand for such software is now being recognised by the Building Design Industry with more and more seminars discussing its use, being organised throughout the UK. In 2010, a 3D Building Information Modelling (BIM) Seminar, which incorporates 3D visual designs along with 4D-Time Estimation, and 5D-Cost Estimation, was organised by 'Construction Excellence' but was cancelled due to lack of interest, in 2011 more Seminars have been held by a number of Organisations and are proving to be very popular.

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However these Seminars focus only on the Construction Team and how 3D Models, created by BIM Software, can be shared throughout the Construction Process. No emphasis has been put on the need to use these modelling techniques to help promote public participation.

It is encouraging that the author has currently been approached by her local authority to create a model and animation to display at a local development Planning Event as they are aware that a 3D model will help the viewer understand more clearly what is being developed.

To further investigate the use of BIM for enhancing a Childs ability to participate within Planning Events a project was selected which focused on the regeneration of a local Play Area. The remainder of this Article will discuss how a BIM Model was created and demonstrate how its use not only allowed for Child Participation but also helped to reduce the financial aspect of the project.

PARK DEVELOPMENT

In May 2011 the Treforest community Group contacted the University of Glamorgan, situated in the same town, and asked for support with a development of the village Play Area, which currently is in need of regeneration.

From the outset of the Treforest Park development children from the local schools were asked to give examples of what they would prefer the development to include. Although the Children had been consulted, it was obvious from discussions with the committee that opinions gathered had been dismissed, this was due to the fact that regardless of how small the site, the children made some very large scale suggestions such as a Rollercoaster and ‘Death Slide’ a piece of equipment usually associated with Theme Parks.

Image 1.1: Existing Play Area

As the site, shown in Image 1.1 above, was only a small plot, measuring less than 150m2. It was obvious that these requests were unachievable, and these suggestions may be due to the child’s inability to visualise space and scale as discussed in research conducted by Day et al in 2011.

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There are many Play Areas in South Wales which makes use of trees and landscape and the Committee was hoping to achieve a similar result, however before contacting the author several quotations from specialist Park development companies were received but were in the region of £70,000, a sum which was not acceptable to them. As a result they contacted the University for help.

Image 1.2: Play Area

As the author had several years experience modelling urban areas via 3D CAD/BIM software packages and creating Animations, she suggested creating a 3D BIM model of the site and designed several pieces of play equipment. This design can be seen in Image 1.2 above.

The Software selected was ArchiCAD by Graphisoft, the data was acquired from OS Plans and Digital Imagery and the proposed park was designed around the Committees requirements rather than the child's own requirements due to the inadequate responses provided. However with the aid of the completed BIM Model the children would be revisited in a hope that a better understanding would be achieved with the aid of 3D Visualisations.

Before presenting the final images to the Committee the author gathered several quotations from specialist companies, including one which had previously supplied the community with the £70,000 quotation.

Sending the 3D images gathered from the BIM Model to the different Park supply companies allowed them to price similar pieces of equipment from their catalogues, and as a result a quotation of £21,000 was received.

When meeting with the committee in July 2011 the author presented them with a large Poster, 3D Imagery and a CD with an Animation, when they expressed positive feedback to this design they were presented with the quotation and were extremely happy to have received a more achievable result.

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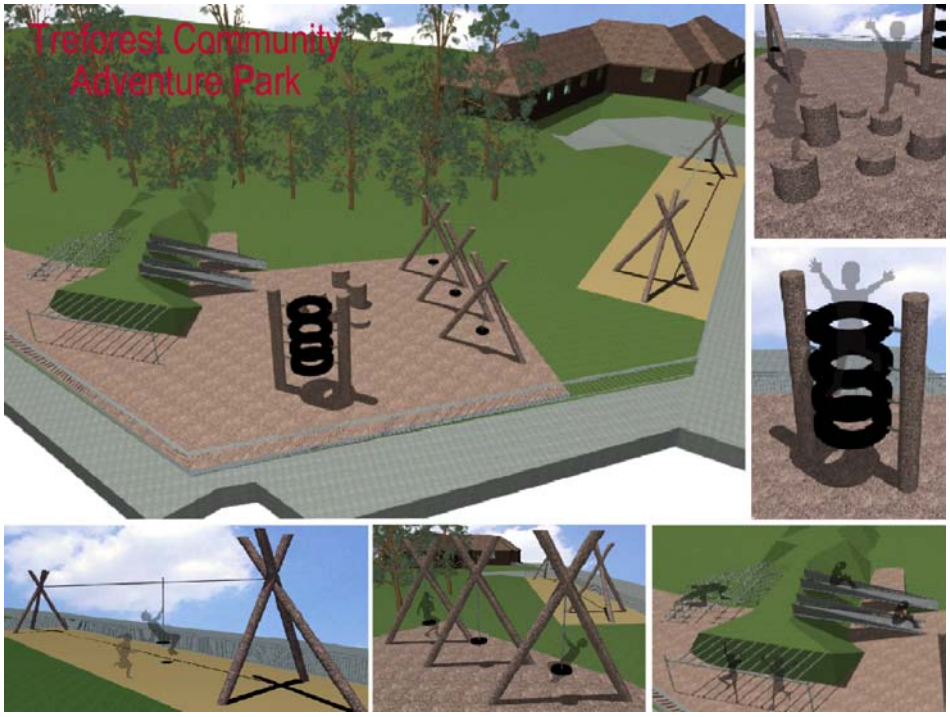

Image 1.3: Play Area Poster

Following the meeting, the secretary of the Treforest Residents Association stated in a letter to the Vice Chancellor of the university that: "We were shown a project that challenges young minds, and is far more fulfilling from all aspects of children's` play. The cost of the scheme is around £21,000, and given the increased benefits, the university`s expertise and support, and the much lower costs, there is a far greater chance that funding and a successful conclusion can be achieved. We are currently in the process of consulting with the children through schools play groups etc, but the early signs are that the children will fully endorse the plan".

With the aid of the provided Imagery, the committee revisited the Schools. The results of the school visits showed that the children could relate to the 3D imagery and therefore had a better understanding of the scale of the area thus, when the children were now asked to give comments regarding the model and what they would like to change or add, the responses were more realistic and merely included a baby swing.

CONCLUSION

This paper has discussed the issues relating to a Childs perspective when asked to participate in the development of a new play area and discussed how these issues were overcome by the use of a 3D Model. It is not uncommon for the opinions of children to be overlooked due to their lack of understanding when faced with such planning issues, and that a range of techniques and approaches should be considered for use in order to ensure that all levels of understanding are reached, and Children are given appropriate opportunity to participate in events which affect them. Furthermore this paper discussed the results from a survey which showed that in order for a child to fully participate and understand a development, there is a need for the provision of 3D views, whether from a 3D Walkthrough or Printed Imagery. With the ever growing 3D trend such as the development of 3D Television Screens and Cinematics, it is

inevitable that 3D technology will continue to grow, and public demand will also increase regardless of age.

In May 2011 the Treforest community Group needed advice in regards to encouraging a group of local school children to participate with the development of plans for a new Park in the area. This paper has shown that without the use of 3D modelling this task was more problematic. When meeting with the committee in July 2011 the author presented them with Imagery and Animations which could be taken into the School and used as a means to help children identify what is available and what is needed. As a result of these imagery it was proven that greater understanding could be achieved and a more realistic discussion with the children could be held. The gathering of data provided by the children during this second discussion proved to be a much more useable result.

FURTHER RESEARCH

In order to try and enhance the participation of Children within the Planning process, other techniques such as user controlled Animations, Augmented Reality within the Design Process, and a study of the requirements of levels of detail within 3D BIM environments in order to increase understanding of a development, will also be investigated.

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A CONCEPTUAL DECISION SUPPORT MODEL FOR SUSTAINABLE HOSPITAL REFURBISHMENT

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ABSTRACT

The refurbishment of the existing healthcare estate in the UK has become far more prevalent in recent times than the new-build approach of the last decade. This coincides with ever more challenging institutional and statutory requirements in regards to sustainability. A challenging economic landscape coupled with the unique challenges and restrictions imposed by works to an existing structure presents the Client and the Design Team with the requirement to make specification and financial decisions based on a 'best fit' and 'best compromise' scenario. The sheer scale of the healthcare estate, and the unique complexity of the hospital as a facility dictate that a Multi-Criteria Decision Modelling (MCDM) approach is essential to allow for the generation of alternatives which may provide the best compromise solution to a given project. This paper discusses this challenge with specific focus on the hospital. The main aim of this paper is to present a conceptual model of the entire decision making process for the activity of sustainable hospital refurbishment. The required phases will be discussed as the core processes required as the basis for a software based interactive model.

Keywords: conceptual model, hospital, refurbishment, sustainability

INTRODUCTION

The time period between the 1990s and the latter half of the first decade of the 21st century witnessed a significant focus on investment for new build National Health Service (NHS) projects. This may be attributed in large part to the UK Governments appetite and subsequent growth of the Private Finance Initiative (PFI). Correspondingly, across the same time frame, there has been a steadily increasing awareness and acceptance on issues of sustainability, environmental protection, and conservation, and perhaps more controversially, the phenomenon of anthropogenic climate change. National and institutional environmental and sustainability requirements have become arguably more onerous as a result of this. Although much focus has been given to the conjoined issues of energy efficiency and green house gas (GHG) emissions reduction through legislation such as the European Energy Performance of Buildings Directive (EPBD) and the respective UK Climate Change Acts, the environmental and sustainability agenda is far more encompassing. It may be argued that addressing the range of issues which will be discussed within this paper is less complex within a new build facility than a refurbishment, as the client, design team and contractor are starting with essentially a blank canvas. A refurbishment project however presents an existing structure with the inflexibility of orientation, materials, services etc, which nevertheless must still meet the legal and institutional requirements. In England there is the added mandatory requirement for all NHS

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Trusts, Primary Care Trusts, and Strategic Health Authorities to report annually to government on sustainability performance (SDU. NHS). To this end, the SHINE Final Report (2010) identifies that the majority of healthcare buildings which will be used throughout the 21st century have already been built, and that the reduction in public spending in the current economy shows no signs of this situation changing anytime soon. Therefore Wilson and Kishks (2011) observation that it is from the existing estate where the functional and statutory requirements in respect of sustainability must be met, seems valid.

THE SUSTAINABLE REFURBISHMENT CHALLENGE

Refurbishment is a challenging activity within its own right. Aside from the constraints placed upon the design team in regards to the requirement to work within and interface with existing structural elements and components; one of the most often cited concerns at the planning stage is the inherent uncertainty of the actual works (Egbu and Lee. 2006) (Quah. 1998). This is a no more prevalent challenge than in the hospital or healthcare setting where there may be the requirement to deliver clinical care on a 24 hour basis, and the potential for a continual and transient traffic of staff, patients, and members of the public.

The Requirement for a Decision Support Model

Given the size of the NHS estate, a complete conceptual (and ultimately operational) model must begin with a high level asset inventory of the entire portfolio. There is of course, no necessity that this be undertaken in every case, but is a decision which may be taken at health authority or regional level as appropriate. This may be further categorised between acute facilities, primary care facilities, or health centres etc, again, at the discretion of the estates management. Regardless of the number of assets to be considered, the holistic decision making process suggested by Zavadskas et al (2008) provides the four phase integrated framework for the complete process (fig.1)

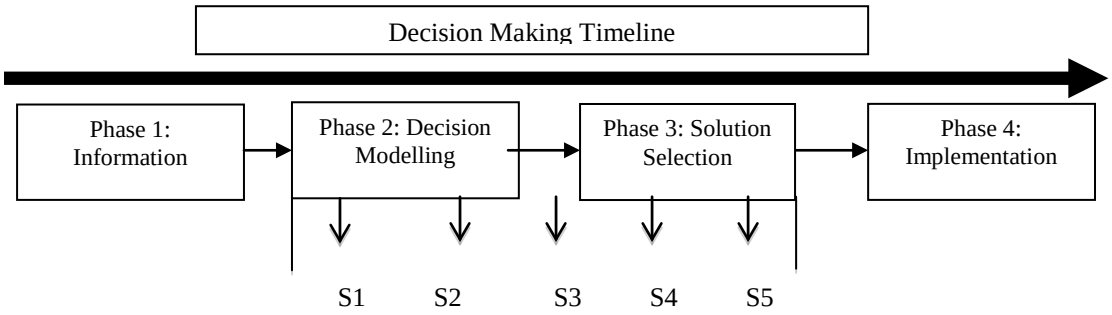


Figure 1: 4 phase decision making process showing the integration of the 5 Step (S) MCDM technique (adapted from Zavadskas et al 2008 and Zarghami & Szidarovszky 2011)

Each of the first 3 phases shown in figure 1 demand decision making processes within their own right, and this will be demonstrated in the ensuing sections of the paper. Phases 2 and 3 are viewed as the heart of the actual decision making process, and multi-criteria decision modelling (MCDM) techniques are applied using the 5 step MCDM process (Table 1) discussed by Zarghami & Szidarovszky (2011). This in turn is the key filtering and calculation process which identifies and measures the subjective information input, and assigns weightings (Step 4) that allow a quantitative and measured solution (or output) which is specific to the facility undertaking the refurbishment process. Given the vast range of hospital types, functions, ages,

locations, and funding parameters; the model provides the opportunity of optimising the planning, design, and construction decisions in a systematic yet flexible manner. To this end, identifying the most opportune moment in the *Business Case* process will be a key factor for the on-going research.

Step	Activity
1	Identify Goal (and Objectives)
2	Identify Criteria
3	Identify Alternatives
4	Alternatives/Criteria Evaluation
5	Make Decision

Table 1. 5 step MCDM process (adapted from Zarghami & Szidarovszky 2011)

It would be remiss not to briefly discuss the context of the decision making process, and how this interacts with the different 'classifications' of multi criteria decision analysis (MCDA). The process shown in Table 1 addresses the *discrete case.* The discrete case is employed in a scenario where there are a finite set of criteria, alternatives, or even evaluations of the alternatives. There is of course, still the potential for a large number of each of the aforementioned as will be discussed below, but the key attribute of the discrete case is that feasibility of each alternative may be filtered down to allow for comparisons and evaluation that satisfies and addresses all (or most) parameters and/or restrictions. The alternate classification of MCDA problem is the *continuous case*. The continuous case possesses a less limiting characteristic and may be applicable to a scenario where the variables are themselves continuous (or infinite). There is a clear advantage for the continuous case in its computational ability, although the argument for a discrete approach is that the model discussed within this research avoids unnecessary mathematical complexity and balances this against the goal of still presenting a multi criteria decision making process which is 'fit for purpose'.

Characteristics of the Research Model

The aforementioned scale of the NHS estate, coupled with the challenges of a sustainable refurbishment process presents a potentially vast choice of decision criteria and ensuing alternatives possibilities. Triantaphllou (2000) recognises the impracticality of considering every possible criterion and alternative with the key observation that MCDM is concerned with seeking the 'best fit' or 'trade off' when faced with such a potentially vast range of possibilities. This is a significant point to understand, in that the decision making process and associated MCDM techniques are by no means a 'black box' or 'quick fix' resource. On the contrary, a measure of professional subjectivity is encouraged in considering the hospital on an individual, case by case basis, as opposed to a 'one size fits all' methodology which is a common industry criticism of current assessment methodologies. The application of the discrete case in creating the model seems clear in this context.

THE MODEL PHASES

Although it is recognised that the 'whole' decision support model is an integrated system, the 4 phase approach described above has distinct interface points. The simplest means of identification is to understand that the final activity within each phase, provides the required level of information to generate the first activity of the following phase. This is most clearly seen in the transition from phases 1 through 4,

although there is scope for considering a feedback loop from *phase 4: Implementation* to each preceding phase of the process on similar or following projects.

Phase 1: Information

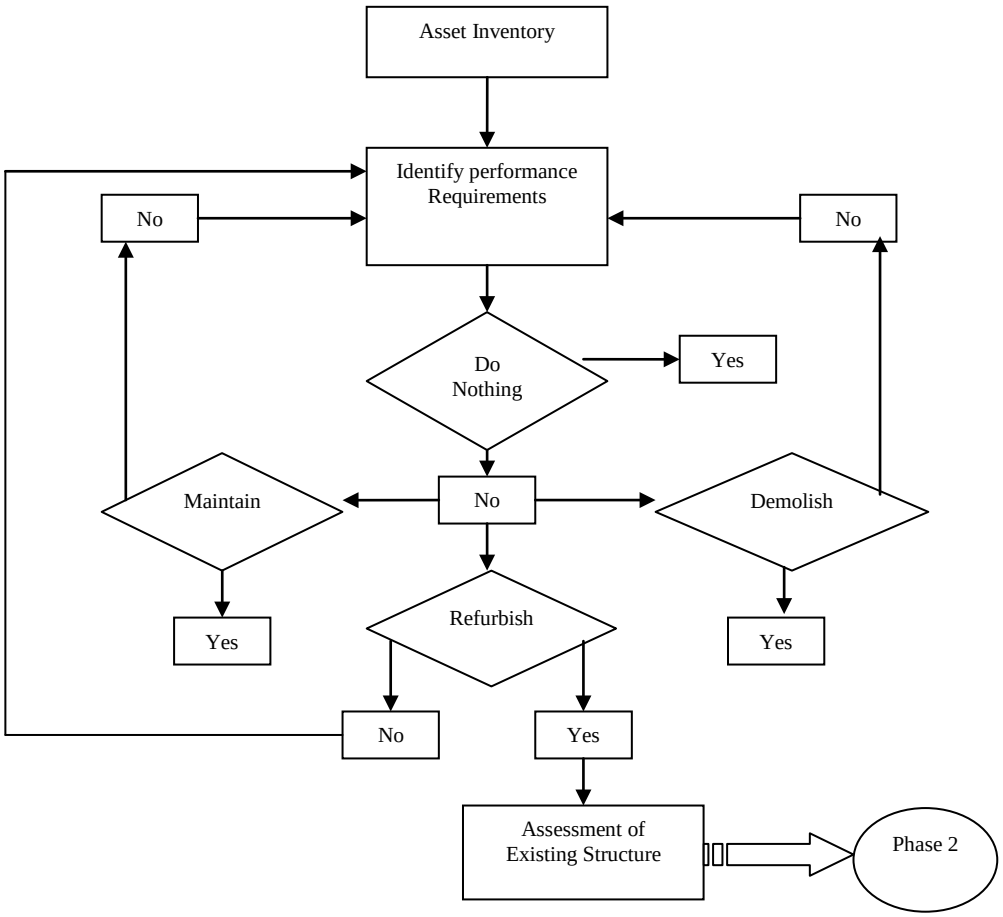
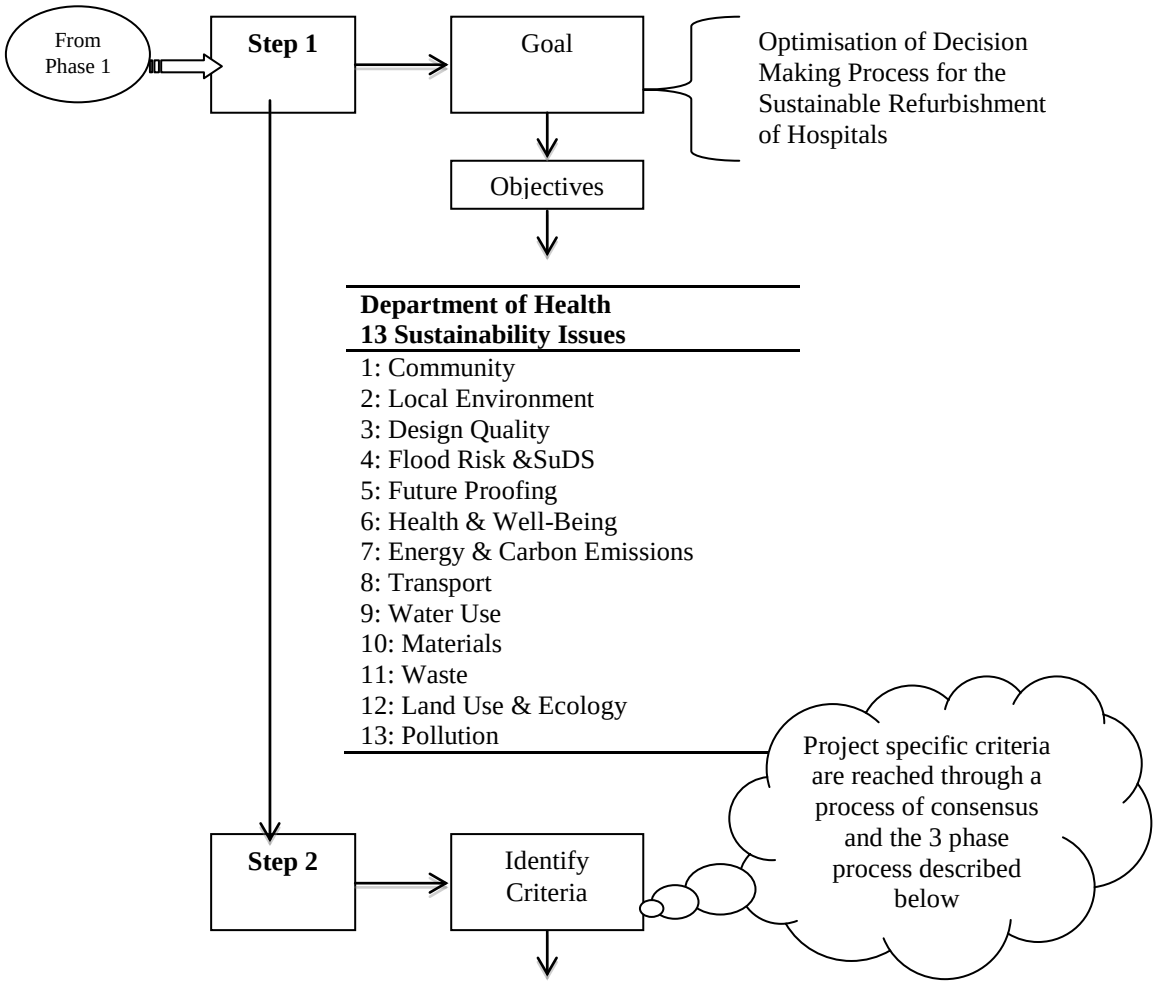


Figure 2. Phase 1: High level decision making process

The discussion has thus far focused primarily on the MCDM aspect of phases 2 and 3 respectively. Although these stages are key to the quantification and assessment of the subjective into the objective, the 'full' decision making process must be understood prior to these activities. Figure 2 demonstrates this process. What figure 2 does not show is the specific variables and trade-off factors assigned to each decision node. A condition survey is vital from the outset, and is shown on an estates level within figure 2 as an 'asset inventory' followed by an appreciation of the required 'performance requirements'. It is completely reasonable to accept that the demolition and subsequent new-build of a facility may be a more viable alternative. Financially this may be driven by the access to funds through PFI (or similar), but a complete Environmental Impact Assessment (EIA) may also encourage the demolition of an ageing or dilapidated building stock which has limited upgrade possibilities. This issue has especial significance with relation to the Business Case process in preparing the *Outline Business Case* if bound by the guidance of the *English version* or *Scottish Capital Investment Manual* with clear impacts affecting the decision of 'preferred way forward'. Assessing where the MCDM aspect of the proposed model most effectively integrates within these processes is a key aim of the ongoing research. As

with most planning, design, and decision making processes, it is envisaged that an iterative approach will be necessary.

Phase 2: Decision Modelling



Generation: Initial set of Criteria	Relevance: Potential set of Criteria	Applicability: Final set of Criteria
Legislation	Relevance to Project	Availability of Data
Codes of Practice	Measurement Duplication	Measurability of Data
Health Technical Memorandum	Goal Conflicts	Ambiguities
Health Building Notes	Importance to Project	Evaluate Applicability
Clinical Output Specification		
BREEAM/AEDET		
Standard Checklists		

Figure 3: Steps 1 & 2 of the Decision Making process (adapted from HTM 07-07. 2009 and Braunschweig et al 2000)

The combination of Steps 1 and 2 are logically placed within the overall Decision Modelling phase (Phase 2) Although the Steps themselves are generic, Figure 3 clearly demonstrates the higher goal and the objectives required in attaining it. The objectives, which in this case are the Department of Health's (HTM 07-07. 2009) own 13 sustainability issues, are also the first layer of 'main criteria'. Each issue is independently considered by means of the process shown in Step 2. It may even be accepted that Step 2 is the generation of 'sub-criteria', and the filtering and selection

process applied to suit. The key aim at this point, is to identify circa 8 applicable criteria to be considered within the MCDM process.

Phase 3: Solution Selection

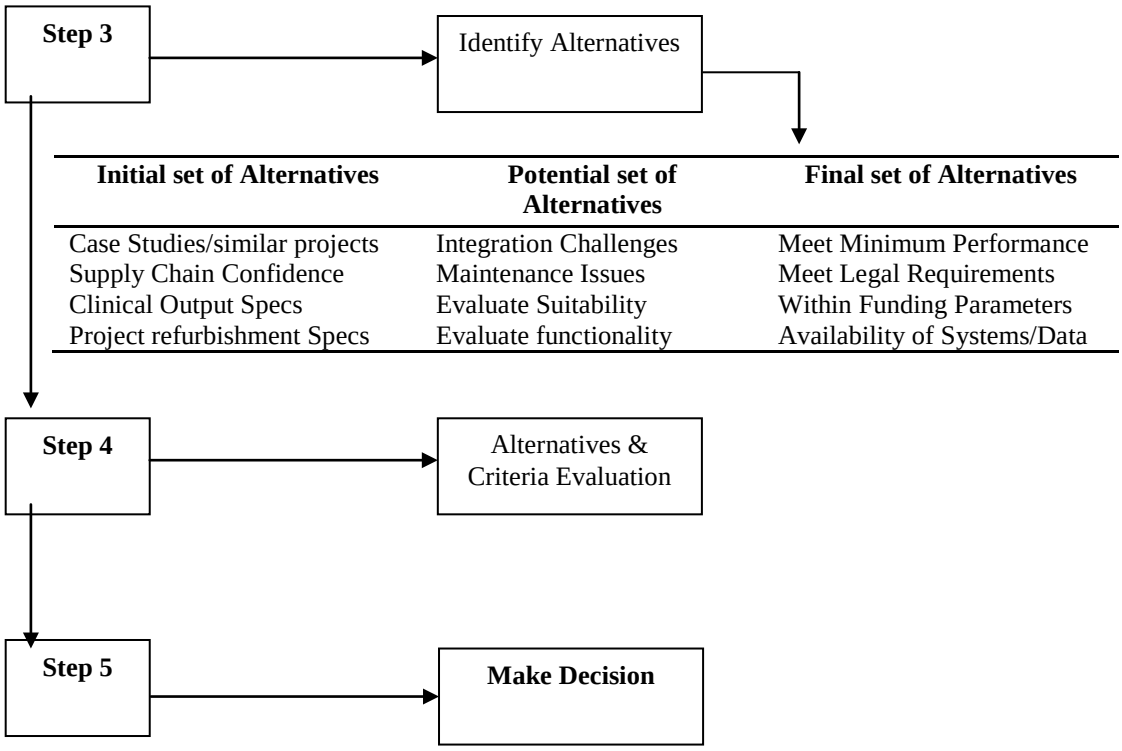


Figure 4: Steps 3, 4 & 5 of the Decision Making process. (Alternatives generation adapted from Kishk et al. 2004)

Steps 3, 4 and 5 of the MCDM process are encompassed within phase 3 of the decision making process, and it is proposed that all 3 Steps comprise the 'Solution Selection' and must be viewed as very much an integrated process. Braunschweig et als (2000) 3 phase generation process is again employed, following Kishk et als (2004) adaptation of the same in filtering and selecting the feasible alternatives. These steps of the model undertake a process of *pairwise comparisons* to compare 'each' criteria against 'all other' criteria. This *weighted evaluation* assigns the final weight of importance. The alternatives are then considered and rated to score how the decision maker assesses the level which each alternative meets the criteria's weighted values (Step 4) This will allow for objectivity to be introduced into the decision making process by means of a simple matrix. Sensitivity Analysis may then be undertaken to prioritise and address any financial constraints not already considered within the generation of alternatives.

Phase 4: Implementation

Arguably the most simple phase in *decision making* terms, the implementation phase takes the decision maker to the point where he/she may begin to specify elements, components or materials. In the *physical reality* however, the implementation phases is far from simplistic. It should be noted at this point, that when an alternative has

been selected using the system described within the paper, the exact same process may be undertaken to derive the best specification choice within the given alternative. A random example to describe this might be that the alternative selected in Step 5 (phase 3) may suggest the most beneficial (and trade-off considered) action would be to insulate an exterior wall. The range of insulation types would then need to be considered as would the insulation thickness which (again) meets the 'best fit' scenario when considering variables such as energy efficiency, emissions reduction, price of materials, cost of works etc.

The Implementation phase must also be considered within the overall Business case. This highlights the criticality of identifying the correct intervention points to introduce the model to the capital investment route and/or subsequent Public Private Partnership (PPP) route selected. Once the decision making requirements reach the contractual and procurement phases, there are obvious benefits and necessity to ensure that the correct parties are involved in the criteria and alternatives selection and evaluation. This in turn demonstrates the iterative nature of the 'utilisation' of the decision making model itself throughout the planning and delivery, and the potential to reconsider the final alternatives by revisiting and altering the criteria and variables.

CONCLUSIONS AND THE WAY AHEAD

It was identified that the refurbishment process is a complex and uncertain activity, and that the NHS as an institution are especially challenged given the vast differentiation in its built estate, and the functional complexities found uniquely in the healthcare environment. The paper has described a decision making process which incorporates the techniques of Multi Criteria Decision Modelling. The objective of the research is to simplify the often mathematically complex field of decision modelling, and a discrete conceptual methodology which centres on the processes of Pairwise Comparison and Weighted Evaluation has been described. It has been shown that given the capital investment frameworks associated with potential healthcare projects, it is critical to identify the intervention point(s) whereby the decision making process is most beneficial, and that the correct relevant Stakeholders are engaged. The discussion has highlighted that a realistic decision making process will always be a 'best fit' scenario based on the subjective approach by the decision maker in regards to criteria and alternative 'trade offs'

The conceptual model in this paper supports a wider PhD research project to develop an integrated decision support model for the sustainable refurbishment of hospitals. Future papers will demonstrate in greater detail the 5 Step MCDM process and associated weighting and alternative selection techniques. The final output of the wider research will be the development of a software based interactive model which will provide the decision makers and stakeholders with a 'user friendly' decision support system.

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DESIGN AND PRODUCTION OF SUSTAINABLE STRUCTURAL CONCRETE

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ABSTRACT

Design and production of sustainable structures have become recently in big demand due to limited resources of materials and strict criteria on sustainability and environmental impact. There are many types of green materials that have come into the forefront in the past related to various areas of construction. Microsilica material is one of them that is used in this research to produce high strength and durable concrete. Relatively new concrete mixture design procedures according to the modified ACI-211 has been attempted to design and produce sustainable structural concrete. Several quality control measures have been applied to measure the concrete high performance such as flow test, temperature, air content, compressive and tensile strengths, Schmidt hammer test, and ultrasonic test. The study showed concrete with high strength of 80 Mpa is produced using carefully selected materials and design procedures. It also showed high workability, low void content, high surface hardness and low internal cracks.

Keywords: Sustainable concrete, ACI-211 code, high compressive strength, microsilica, workability.

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INTRODUCTION

The concept of sustainability is brought up for the betterment of human species and not for the earth. The Earth can survive without humans. Sustainability is for human being to survive on earth. Everyone is aware of the fact that the life on earth is degrading day by day. The quality of life on earth has gone from best to worst in the past 150 years. We should all work towards making our environment green and sustainable because we are the ones who are responsible for getting it into such a ruined state. With a drastic growth in the world's population, there also is a dramatic increase in the demand for buildings and homes.

The industrial revolution may have been partly responsible for the change in the way that homes and buildings were constructed. The industrial revolution brought about the invention of the steam engine, discovery of low-cost petroleum, improvements in coal mining, and the invention of rail transportation that helped provide an environment which altered the way people designed and constructed buildings and other products because of the benefits of concentrated energy. No matter how cold or inhospitable the climate may seem, buildings and houses could be built since they could be heated with wood, coal, and oil. A limitless amount of energy supply led to little thought being dedicated to the impact that the extractive and refining processes of fossil fuels would have on the environment. As a result, the price of energy today has increased because of the lack of its availability and finally the realization has dawned upon mankind that consuming large quantities of fossil fuels actually prove costly and damaging to the environment.

Construction primarily is the building of structures to provide shelter and storage, transportation, and utilities that service the day-to-day activities of people. As time has progressed we have come to see a much broader description of construction with terms such as sustainable construction, green building, climate change, and environmentally friendly building being used when defining and describing construction projects.

A deeper study of these terms depicts building processes and practices that prove to make use of resources efficiently and at the same time are environmentally responsible in the planning, design, and construction of structures as well as their demolition towards the end of their life cycle. It is to be noted that all of the above mentioned benefits are in perfect coordination with the traditional perception of construction that highlights durability, economy, utility, and comfort. "Green building is ultimately about the relationship of a house and its occupants to the world around them. It's a process of design and construction that fosters the conservation of energy and other natural resources and promotes a healthy environment.

Green construction

A green building is one which uses less water, optimizes energy efficiency, conserves natural resources, generates less waste and provides healthier spaces for occupants, as compared to a conventional building. A significant shift towards the development of green construction projects is highly noticeable nowadays. Building green does not necessarily mean major sacrifices in comfort, convenience, or even safety in the design and construction of homes or buildings. Minor changes in site planning and layout can

result in the alteration of water runoff to great significance and at the same time eliminate subsequent pollution issues as well. The orientation of a home or building in a way that allows a passive solar gain in the wintertime can reduce heating costs. Roof overhangs can provide shading in the summertime and can offer budget savings on energy costs and the eventual net impact reduces heating and cooling costs for the occupants.

The subsystems of a home or building include the site, foundation, framing, roof, electrical, ventilation--heating and cooling, door and window systems, insulation, plumbing, and even the landscaping details. Each of these systems contributes to the overall building design, form, function, and as such efficiencies, economies, and impacts on the environment can be readily realized through careful planning.

The addition of efficient heat pumps or geothermal heating and cooling systems can provide comfortable interiors at lower energy costs and impact on the environment while solar panels and photovoltaic arrays can provide heat and electricity. Door and window construction, along with building insulation, can provide significant savings and comfort. It is important to note that green construction is not only limited to new buildings but also involves renovation of existing structures to achieve the green outcome, and this is taking place around the world currently and at the same time is also a topic for numerous case studies. At present in Dubai if there is one shopping mall that has done justice to the green building concept then it will be none other than Dubai Festival City where the ceiling of the entire structure is made up of glass facades. This enhancement in the structure allows for sunlight to filter through the glass in the mornings where the sun is always there to greet us in a country such as the United Arab Emirates where you have an average temperature of about 40 degrees almost all year round. By allowing the sun's rays to come through, the entire mall is illuminated all the way till the afternoon which allows for a significant saving in light electricity till evening arrives. Another mall which follows the same concept of having glass facades as the ceiling is Marina Mall in Abu Dhabi. Along with the saving of electrical energy, the mild rays of the sun filtering through the glass give a very relaxed feeling to the visitors of the respective malls.

In New Delhi, India, a structure that happens to be considered as one of the greatest architectural delights in the world when it comes to culture and religion is the Baha'i Temple or more often referred to as the Lotus Temple due to its flowerlike shape. Inspired by the lotus flower, the design for the House of Worship in New Delhi is composed of 27 free-standing marble clad "petals" arranged in clusters of three to form nine sides. The number "9" is considered a very sacred number in the Baha'i religion and as a result everything from the number of petals to the door entrances as well as the pools is nine in number. The main attraction for this structure when it comes to green building is the fact that there are no air conditioners installed in it. All of the cooling that is achieved in this magnificent structure is done through careful designing of the petals and placement of the nine gigantic pools around it that allow for the coolness of the water to be trapped within the giant petals that eventually drive the winds in and provide the perfect temperature all over the temple.

Cementitious Materials

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One of the largest construction materials that are produced and consumed nowadays is cementitious materials. They were used as floor lime mortar more than 9000 years ago in the Middle East. In addition, gypsum based mortar was also used in ancient Egypt around 3000 BC in the construction of the pyramid of Cheops. There was a dire need for a cementitious material that could harden under water in order to support piers and sea walls and this in turn motivated engineers and scholars to search for the right materials. The breakthrough came in around 27 BC when the Romans mixed lime mortar with fine volcanic ash or used a material named pozzolana. This allowed the Romans to create a cementitious material that could harden under water. The major leap forward in the development of the cementitious materials was in the 18th century when scholars such as John Smeaton, James Parker, and Louis Joseph Vicat contributed in greatly improving cementitious materials.

It was in the 19th century finally when Henry Le Chatelier invented Portland cement in his research by stating that tricalcium silicate is the main cementing phase of cement. He was able to explain the chemistry behind Portland cement and the many phases it runs through. Along with this the work of numerous other scholars in the 20th century led to the development of chemical admixtures. Furthermore, continuous research and development led to better understanding of the materials and creation of concrete with high performance and strength. All of this has facilitated the construction of many large structures never seen in the history of the world such as the Petronas towers in Malaysia, Burj Khalifa in the United Arab Emirates and the Empire State Building in the United States.

Sustainable Concrete

Sustainable concrete is a type of high performance concrete since it utilizes the materials to produce a concrete with high compressive strength. The materials used in the concrete mix include coarse aggregate, fine aggregate, cement, superplasticizers, micro silica and water. It is critical to use materials of high quality and strength or otherwise the failure could come from the aggregate. Moreover, quality control in casting the concrete is also very important it should be casted at control temperature and well cured or the failure could come from a weakness in the cement paste. Moreover, to produce concrete of high strength it is important to control the temperature, the materials quality and it must be well cured after hardening. However, unlike conventional concrete where the weakness is usually in the cement paste and the bond in high strength concrete the bond and cement paste is strong but the weakness mainly comes from the aggregate. That’s why one of the most important things in producing high strength concrete is to use high quality aggregate with high compressive strength. In addition, it is critical to know the compatibility of cement and superplasticizers. The more compatible the more effective it will be in improving workability and reducing water cement ration thus increasing the strength and durability of the concrete. One of the main draw backs of high strength concrete is that it is not very workable which makes it labor intensive and time consuming. However, if done well and with care its benefits are great such as high strength, durability and long service life. From the general principles behind the design of high-strength concrete mixtures, it is apparent that high strengths are made possible by reducing porosity, inhomogeneity, and micro cracks in the hydrated cement paste and the transition zone. In high-strength concrete, the aggregate plays an important role on the strength of concrete.

The low-water to cement ratio used in high strength concrete causes densification in both the matrix and interfacial transition zone, and the aggregate may become the weak link in the development of the mechanical strength. Extreme care is necessary, therefore, in the selection of aggregate to be used in very high strength concrete.

DESIGN CRITERIA

The objective of this research was to produce high strength, low carbon and sustainable concrete with a compressive strength of 80Mpa. The project included the following:

ACI-211 design procedures:

Step 1: Selecting the Water/ Binder Ratio
Selection of the W/B ratio depends on the target concrete strength and the compatibility of the super-plasticizer with the cement.

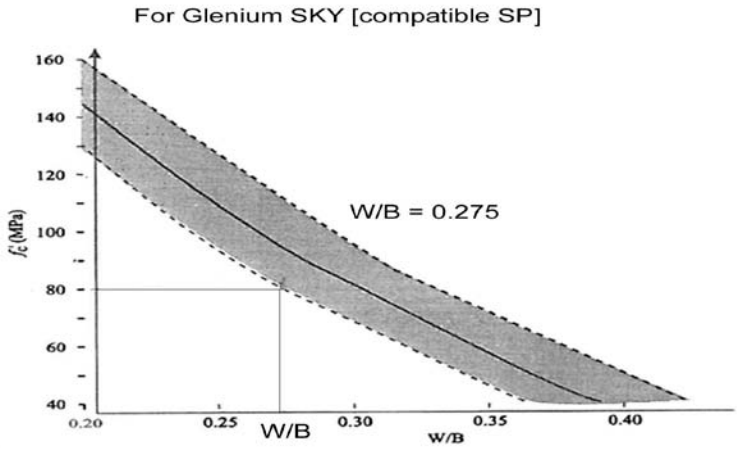

Figure 3: W/B ratio selection

Step 2: Selecting Water Content
One of the most important parameters when it comes to strength is water content. Water is required to guarantee a workable concrete however, it reduces concrete strength drastically. Subsequently, the lesser the water in the mix the stronger and more durable the concrete is. The selection of the water content depends on the dosage of super-plasticizer. The higher the super-plasticizer dosage the higher is the water content. Below is the graph used for the selection of the water content.

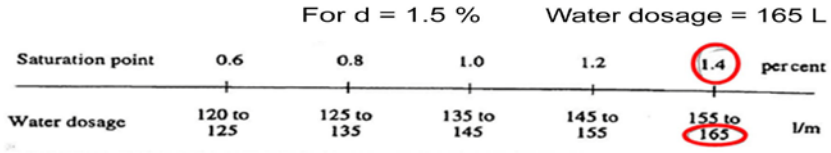

Figure 4: Water Content Selection

Step 3: Selecting Coarse Aggregate Content
Coarse aggregates make up the bulk of a high strength concrete. The selection of the coarse aggregate content depends on the shape of the available coarse aggregate. The given coarse aggregate is average to cubic.

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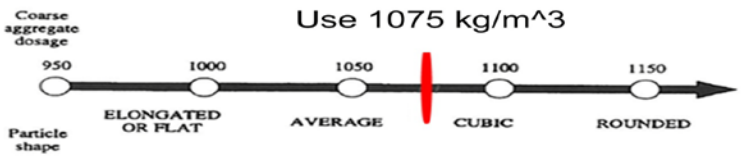

Figure 5. Coarse Aggregate Selection

Step 4: Cement Content
The binder content is another important factor controlling concrete strength. It's made up of 90% type I OPC and 10% of micro-silica. The binder content is determined by the water content and the water-binder ratio previously obtained.

Step 5: Mix Design Calculations
Once the above parameters are fixed, the rest of the mix design calculations could be performed based on the mix design sheet. The required calculations to determine the mix proportions are shown in the following table. The mix properties are outlined along with the super-plasticizer calculations in part one while the mix design calculation results are presented in part two.
The trial batch mix can be calculated in column 6. Each number appearing in column 5 has to be multiplied by a factor *f,* equal to the desired mass of the trial batch in kg, divided by the mass in box 16.

Required Samples		Weight (kg)	Total Weight (kg)
Type	Quantity		
Cube	6	2.5	15
Cylinder	2	13	26
Beam	1	10	10
Air test		15	15
		Sub-total	66
		10% wastage	6.6
		Total	72.6

f = 72.6 / 2373 = 0.030594

RESULTS

Fresh Concrete Results:

A- Flow Test: Flow test resulted in the following:

d_{max} = 650 mm, d_{perp} = 630 mm, S = (d_{max} + d_{perp}) / 2 = 640 mm

B- Temperature:

The temperature measuring device was used to measure the temperature of the fresh concrete and it turned out to be 23.4^{o} C.

C- Air content:

The concrete pocket (cylinder) was used to measure the air content which turned out to be 1.7%.

General Features of Concrete Mix:

Temperature (^{o}C)	23.4 ^{o}C
Air Content	1.6%
Flow Test (mm)	650, 630mm

Compressive Strength of Cube of concrete specimens, Sample age at test: 3 days Curing Condition: Water tank

	Compacted					
Sample	1	2	3	4	5	6
Compressive Strength at 3 days (Mpa)	47	48	47	45	47	48
Projected Compressive Strength at 28 days (MPa)	80	82	80	78	80	82

Splitting Tensile Strength Cylinder Concrete Specimen: Sample age at test: 3 days Curing Condition: Water Tank

Sample	Average diameter (mm)	Average length(mm)	Maximum Load (MPa)	Projected Load at 28 days (MPa)
1	100	200	3.72	5.58
2	100	200	3.09	4.64

DISCUSSIONS

The fresh concrete mix resulted in a flow test of 650 mm and 630 mm which represented high workability. The temperature of the mix was found to be around 23.4 °C and had an air content of 1.6%. The cube with the highest projected strength was 82 Mpa and it failed under the load of the compressing machine which indicated that it was of strong bond and had little voids that resulted in it exploding.

The cylinders had projected tensile strengths of 5.58 Mpa and 4.64 Mpa respectively in the tensile splitting test. The projected modulus of rupture of the beam was found out to be 10.84 Mpa. The failure could have resulted from the aggregate and because it took a long time to settle in the first place meant that the concrete would take a longer time in curing to harden to the design strength. Moreover, the harsh mix and hard workability owing to the weakness of the mixing machine could have also contributed to the failure.

The crushed cubes had a couple of cracked aggregates and major failure on multiple planes. The Schmidt hammer test gave a lower compressive strength than was found by the crushing machine. However, this could result from the Schmitt hammer being uncalibrated and because it is a non-destructive test which means that the numbers are approximate of the real strength. The ultrasonic test is a non-destructive test that tests the concrete quality and cohesion by finding the velocity of the wave travel in the concrete. The ultrasonic test detects if there are flows inside the concrete.

CONCLUSIONS

High strength concrete mix design was carried out according to ACI-211 procedures. Fresh concrete showed high workability measured as slump flow of 635 mm. The concrete resulted in very low air content of 1.6% Microsilica was used to produce sustainable concrete with average high compressive strength of 80 Mpa.

The hardened concrete showed high surface hardness. Failure showed explosive mode and occurred mostly through the aggregate particles. The resulted concrete is regarded sustainable because waste materials were used and produced high strength, workability and durability.

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FOOD IN SUSTAINABLE DEVELOPMENT

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ABSTRACT

The concept of sustainable communities in the UK has lead professionals in the built environment to embrace ideas about energy efficiency, waste recycling and water use with direction on these being included in policy documents such as UK Building Regulations. These regulations have begun to impact on designs for new developments within sustainable communities. As yet food, although being identified as a scarce resource in a period of rising population and climate change and despite being a significant contributor to carbon emissions rarely features in government policies or is even considered by built environment professionals in their designs; it still being the assumption that people will buy their food. Drawing on a three year evaluation of Harvest Brighton and Hove a lottery funded project to improve access to local food and embed sustainable food policies within an urban community and following on from a paper presented at Cobra 2010 this paper identifies how the urban food movement is beginning to influence policy makers in Brighton describing the new Planning Advisory Note and other key project outcomes. It provides planners, designers and developers with some innovative ideas about how food can successfully be included within the design processes for buildings and landscaping in the urban realm.

Keywords: built environment, food, innovation, sustainability, urban communities.

INTRODUCTION

The climate change debate combined with rising urban population has hi-lighted the significance and contribution of food miles to the carbon foot-print of cities and urban environments due to dependence on global, rather than local networks for food supply (Deelstra and Girardet, 2008). In addition the contribution that urban agriculture makes to community cohesion and health and well-being is increasingly recognised and bio-diversity of urban form is increased when significant areas of vegetation are added (Jean-Pierre,L 1998). So what are the obstacles facing those who try to embed urban agriculture into our cities? What do Built Environment researchers need to consider to preserve food supplies and biodiversity within the increasing urban sprawl?

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The report from the 3rd (SCAR) European Commission Standing Committee on Agricultural Research Foresight Exercise Feb 2011 concludes with the following relevant main messages:

1. The increasing scarcity of natural resources and destabilisation of environmental systems represents a real threat not only to future food supplies, but to global stability and prosperity.
2. Many of today's food production systems compromise the capacity of the earth to provide food for the future
3. Drastic change is needed in regard to both food demand and supply
4. The average Western diet with high intakes of meat, fat and sugar is a risk for individual health , social systems and the environmental life support systems
5. Coherence between food, energy, environmental and health policies and across all levels of governance are pre-requisites for a timely transition to sustainable and equitable food systems
6. Sufficiently –orientated research, innovation and communication must become the new priority
7. A radical change in food consumption in Europe is unavoidable to meet the challenges of scarcities.

Between now and 2050 a growth in global population and changing diets in emerging countries are expected to bring about a 70% increase in food demand, as an average of all different possible scenarios (Freibauer et al 2011). At the same time depletion of fossil fuels will increase the demand for bio-fuels, natural resources are being depleted and climate change is affecting the global productivity of crops how then can more resilient and sustainable systems feed a global population rising to nine billion people?

To the Built Environment Professional it is interesting to note that against this back-drop of European concern for resource depletion, the new requirements, driven by policy makers for example UK Building Regulations or the Code for sustainable homes (UK department of communities and local government 2006) or BREEAM ratings (BRE) provide a set of sustainable design principles 'rating the whole home' under design categories which fail to recognise food as a scarce natural resource instead they focus on items such as:-

- Energy and CO2 emissions
- Water
- Materials
- Surface water run off
- Waste
- Pollution
- Health and well-being
- Management
- Ecology

Whilst there is consideration of provision for low energy transportation (bicycles) and the opportunity to use private out-door space, and water butts they fail to give consideration to food, accepting the age old belief that people will 'buy' their food but it is time to consider where from and the impact of the importing of food into urban spaces against each of the above criteria.

Within Built Environment research it is clear that with increasing urban populations there is a need to engage in a coherent and innovative debate about food, energy, the environment and health.

This paper looks at the on-going evaluation of a project which has been running in Brighton and Hove to increase the amount of food grown within the city and considers how some of this learning can be translated into more resilient food systems for urban city dwellers.
Incorporated within the project are the following aims:-

- *'Increasing the amount of food produced locally by increasing the space available to produce food, enabling communities to manage land sustainably and increasing the productivity of the land.*
- *Improving access to local food by increasing opportunities across the city to grow, taste and buy local produce*
- *Increasing Skills and confidence of local people in growing food and*
- *Improving awareness of the benefits of growing, buying and eating local produce across all sections of the community.'*
- *'Ensuring strategies and guidance that support land use and infrastructure for urban agriculture are developed and implemented within the city and elsewhere'.*

HARVEST BRIGHTON AND HOVE

Harvest Brighton and Hove is a 4 year £0.5M Beacon lottery funded project funded to increase the amount of food produced within the city as a result of global concerns over increasing urbanisation, expanding population and climate change. (Madgwick 2010)

It considers the need to refocus on the use of photosynthetic processes in cities which can provide a host of benefits to urban residents (Deelstra and Girardet 2008) most notably environmental benefits e.g. preserving biodiversity, tackling waste and reducing transport, social benefits e.g. environmental awareness, education and community engagement and financial benefits e.g. supporting local economies in line with localism agenda where food has become a common entry point for consumers to think about the impact of their choices on the local economy.

The evaluation of the first year of an urban growing project (Madgwick 2010) aimed to consider how the project developed in the first year against a set of outcomes identified in the Business plan as above, this current paper considers further the out-comes.

Methodology

GIS is used to record information on a map to indicate the changing position regarding Open Space and its use within the City boundary. Further evaluation of the project which is extensive and broad comprises both quantitative and qualitative tools for project partners and stakeholders in the form of questionnaires, some specifically adapted to capture information which is relevant to the five distinct goals listed above.

Project Outcomes

New growing spaces

There are currently nearly 60 projects identified within the city boundary where food is now being recorded as produced by community groups. These range from small vegetable plots in public parks, to community allotments often being run as community support schemes for individuals who are marginalised, schools and gardens of care homes etc.

Out of the 60 projects identified, the vast majority take place in allotment sites or in gardens of existing properties where service users, vulnerable people, or people with learning difficulties are encouraged to grow to develop social skills and learning, in addition there is a plot where students are carrying out growing, a small orchard which has been planted through local fruit futures and a vegetable garden at a children's centre.

Grow your neighbour's Own

The project has resulted in 27 gardeners gardening 17 gardens in other people's homes. The learning around this project appears to indicate the difficulties in seeking successful matching pairs which is more complex than originally envisaged, this is sometimes due to location, since those home owners with the biggest gardens tend to be outside of the city.

There has been much made of the scheme in the local and national press, yet it appears that it is difficult for people to give up their own garden to complete strangers. This could benefit from further research.

Scrumping project

The on-going picking of fruit trees in public spaces, dilapidated orchards and in private gardens by trained volunteers, who then use the food for education, for re-sale or for turning into chutneys continues. Fruit collected included apples and pears, cherries, cherry plums and walnuts. All of this is undeniably 'local' produce which contributes to healthy eating programmes through-out the city.

The weight of fruit in total collected in the second year was 3000 k; and this continues to grow; lack of volunteers being the limitation in expansion as more trees are already identified for the on-going continuity of the project.

A new direction for the project; given that financial sustainability is part of its core driver may be to consider picking from those trees with the greatest yield.

This project serves to illustrate the part which trees can play in feeding urban populations since trees are often part of new developments in towns. It is well established that municipal authorities in the UK provide staff to take care of the their parks and gardens, maybe taking care of the fruit and nut trees within our city boundaries is a future requirement. The project has been able to secure some premises within a local park with direct access onto the South Downs, when fresh juice has been sold at these premises, for example on summer weekends this has proved popular with cyclists and walkers this leads to more sales and less pasteurisation required. This builds on other research (Madgwick, Ravenscroft 2011) which determines that local food becomes more attractive when located in a position which is conducive to its consumption.

Allotments

Allotments are generally better used around the city and when new ones have become available a number of them have been given to community groups which have

essentially increased their production. Brighton and Hove now has 36 sites with 2,800 tenants.

In addition learner plots have been created, which are small plots to enable people to learn to grow on. With on-going support from the Local Authority another 100 new allotment plots have been created in the city and most redundant plots have been brought back into use.

The plots are being inspected regularly to increase food production and the local authority is working on provision of adequate water supplies to new and existing plots.

Breaking new ground

Much time has so far been invested in supporting local projects to set up new growing spaces. As identified in 3.1 a number of derelict plots of land have been resurrected as growing plots.

New projects are springing up over the City where the motivation is individuals and groups wanting to produce food. One example is a group of residents living near a station which approached Southern Rail about growing food in some of the neglected spaces around the station and along the railway line.

In addition, support is being given to a group of tenants who wish to set up a 'patchwork garden' around the base of their tower blocks. Ecological impact and social impact will be interesting to note.

Training programmes and communications

The Team at Harvest excel in promoting training events. Some are held in-house and others take place in the established community gardens around the city There are up to 20 events taking place within the city every month, though it is hard to evaluate the impact of these courses, particularly in any long term way.

In excess of 100 further people have attended courses. Everybody who attended the courses stated that they were more confident growing food. One stated that they had 'renewed enthusiasm for growing vegetables' another stated that they would put their name on the allotment list and start growing on their balcony.

In addition training courses have been held on bee keeping and bio-diversity. The web site hits continue to increase and media interest in Harvest continues from both local and national press and television.

The small grants scheme

Applications were received from 50 groups. Harvest have been able to fund 34 projects in schools and communities 20 of them encouraging participants to eat more local food and grow more of their own. The other 14 projects focus on improving cookery skills and increasing healthy eating

Local food events

There have been a number of local food events held around the city. The local food week in September has become a success with around 20 businesses taking part and demonstrating creative ways of growing vegetables in urban spaces and a local food picnic being held in a park. In addition events continue at a rate of around 10 per month such as:

- Seedy Sunday where seeds are brought and sold
- Cook ability

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- Container gardening
- Seed-bomb workshops

Brighton, with the only green MP in the House of Common makes much of its local food culture and restaurants and fairs advertise their connections to the local food agenda.

Demonstration garden

The demonstration garden has doubled in size after discussions with the Local Authority. New volunteers have offered support and the garden provides invaluable advice to members of the public around growing in small urban spaces.

A regular blog keeps people informed of developments in the garden suggesting what to sow and when and it is assumed that this is copied in various gardens around the city.

The demonstration garden produces a wonderful marketing opportunity for harvest and has provided inspiration for work in other parks around the city which have set up similar schemes, pumpkin patches and herb beds etc.
In addition, it is hoped that it has influenced people to start growing within their own back.

Community composting

Through a community association there has been established two locations where around 45 house-holds compost their un-cooked vegetable, fruit waste, tea bags and coffee grounds. It has been estimated that this saves 3 tonnes of organic waste from landfill per year.

INFLUENCING POLICY

Since one of the aims of the project were to ensure strategies and guidance that support land use and infrastructure for urban agriculture are implemented within the city and elsewhere, there was a discussion held with city planners around how the project could best be used to influence policy. As result of this there was a suggestion that a Planning Advisory note (PAN) could be drawn up, this would provide some basic technical considerations as well as offer inspiration on how food may be incorporated into new proposals. Consultation was sought from groups representing the following: Allotments, Ecology, Arbiculture, Environmental Health, Healthy Urban Environment Group, Housing Development and Economic Development. As a result of this and out-comes of the project to date a draft was drawn up which was adopted by the local authority in September 2011. The PAN is the first of its kind nationally and is designed to be an innovative model that other Local Planning Authorities might adopt.

Planning Advice Note

The Planning Advice Note applies to new build commercial, residential and mixed use developments and it is intended to be used as a guide to what is achievable depending on the context of the development.

Technical and Practical Considerations

It was agreed that the initial considerations should be of the following:

- Land:

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- Use of building
- Aspect and light:.
- Water:
- Wind:
- Soil/growing medium:
- Compost:
- Contaminated Land:.
- Access:
- Storage:
- Management:

Planning and Design Regulations
Depending on these practical and technical considerations there are several design options which are referred to:-

- **Rooftops**
  Intensive accessible green roofs can be used for edible plants subject to adequate design for loading capacity.
- **Balconies**
  Design of balconies can provide small spaces for individuals to grow a limited selection of plants and are particularly suited to high density residential developments. It is critical to consider aspect.
- **Walls**
  Vertical growing on external and internal walls, the latter usually in atriums or courtyards, can be adapted for food production. Maintenance of productive green walls is high, as they will require harvesting and seasonal replanting, and therefore will need to be accessible.
- **Internal atriums/courtyards**
  Designing buildings with atriums or courtyards with adequate exposure to sunlight can create deliberate opportunities for food growing allowing high value tender plants such as tomatoes and citrus fruits to be cultivated. Ground level beds or planters can be used, as well as living walls. Care must be given in internal spaces to providing irrigation systems and allowing for water run-off.
- **External landscaping and integrating ornamental with edible planting**
  Depending on the land available around the building or on the site various options are available. Cropping can be integrated within areas of soft landscaping with a minimum cost outlay.

It is still early to comment on how the plan has been received by local developers and whether it is likely to be implemented by other authorities. Results may be small scale: the provision of allotment space within residential developments; landscaping with edible plants; planting fruit trees in place of non productive varieties.

CONCLUSION

There is still much to do learn regarding embedding sustainable food consumption within the city in its wider context but there are certain things which are beginning to happen :-

An urban growing programme such as harvest can start to make better use of some of the land in urban areas if food is seen as a priority. In Brighton, much of this land to

date has been local authority land and existing gardens but with increased research and innovation and using the Planning Advisory Note there is the as yet unexplored potential to develop this to private or commercial land and buildings. In addition the community composting scheme provides invaluable resources from existing city dwellers to ensure nutrients are fed back into the land and thereby continue to make it rich and fertile and Seedy Sundays encourage the swapping of seeds
The development of resilient new food systems in the city may add to its productivity. In reducing transport and packaging costs the growing of food within the city may help to conserve the fossil fuels.

With its wide remit for education, harvest has not only tried to teach people to be better at growing but additionally encourage people to eat more healthily and respect biodiversity, it aims to add to, not replace an existing agricultural supply of food currently delivered to the city and can therefore assist in the increased demand which comes from the rising population.

The Harvest project works with schools providing education on growing and on healthy foods, individual projects such as the scrumping project, regularly presses fruit at schools to demonstrate to children the pleasures of drinking fresh juice without additives. The wide extent of new community allotments encourage people to become more active and lead healthier life styles, the more people engaging in growing the more opportunities to cook from fresh and to understand fully the implications of eating high levels of meat, fat and sugar.
Coherence between food, energy, environmental and health policies sits at the very heart of the project and policy influencing is a key out-put being achieved by academic evaluation critical appraisal and understanding of the key drivers behind the project.

Certain plants which can be grown in cities may well become established as local products whilst it is still accepted that vast amounts of food will still be brought in to the city. Harvest produces via its web site a central place to co-ordinate activities regarding local food. In addition, increasing green roofs, balconies and green walls and creating green pathways through cities can increase bio-diversity.
This paper aims to encourage researchers in the Built Environment to critically evaluate existing literature and ideas on ‘sustainable communities’ so that this research can be extended to contribute to the developing urban form.

A radical change in food consumption in Europe is unavoidable to meet the challenges of scarcities Consumption and production is at the heart of Harvest Brighton and Hove in both the production of new food systems and the education of the wider community.
To add to this; one of the challenges facing the Built Environment professional is to try to engage others in the notion that food as a scarce recourse needs to be considered along with water and energy in design codes for new developments if we are to be able to feed the growing urban population over the next 30 years.

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MAINTAINING PLACE: RESILIENCE AS A MEANS OF PROTECTING CULTURAL BUILT HERITAGE IN THE FACE OF NATURAL DISASTERS, A THEORETICAL OVERVIEW.

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ABSTRACT

Over the past decades, many parts of the world have been subject to various natural disasters, including the 1995 Kobe (Japan) and 2011 Christchurch (New Zealand) earthquakes; tropical cyclones Larry (2006) and Yasi (2011), Queensland (2010–11) floods, the Ash Wednesday (1983) and Black Sunday (2009) fires in Australia; hurricane Katrina (2005) in USA; and, the tsunamis in South and Southeast Asia (2004) and Japan (2011). Natural disasters such as these appear to be a feature of the global climate and landscape, and they continue to pose economic, social and environmental challenges to many nations. Disaster responses have often focussed on the built environment, health and social factors. However, as identified in a number of key reports, cultural values, such as cultural built heritage (CBH), are also likely to be affected by natural catastrophes. Considering the historical, national and communal implications of CBH, there has been surprisingly little debate and research on the question of how to protect CBH from risks posed by changing climate and increased natural hazards. Building upon a review of existing scholarship on CBH, resilience, and disaster recovery, this paper proposes an alternative strategy for preparing, recovering and conserving CBH. Resilience is explored as a means of developing strategies for recovering and preparing the CBH.

Keywords: Cultural built heritage, disaster recovery, natural disasters, Resilience.

INTRODUCTION

Over the past decades, Australia has been subject to a number of natural disasters, including the tropical cyclones Tracy (1974), Larry (2006) and Yasi (2011); the Sydney Hail Storm (1999) and the Pasha Bulker Storm (2007); the Nyngan (1990), Charleville (1990) and Queensland (2010–11) floods; the Ash Wednesday (1983) and Black Sunday (2009) fires; the Great Easter Drought (2002–06); and, the Newcastle (1989) and Ellalong (1994) earthquakes. Natural disasters such as these 'are a feature of the Australian climate and landscape' (DPC 2009: iii) and continue to pose

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economic, social and environmental challenges to the nation. Two factors that are believed to enhance the risk of natural disasters are climate change and urbanisation (The World Bank 2010). Due to climate change, hazards (i.e. natural phenomenon with adverse effects, such as floods, storms, droughts and earthquakes) are increasing in intensity, frequency and distribution. Coupled with the increased size and density of Australian cities, this exposes a growing number of people and properties to the risk of natural disasters. Responses to the potential threat posed by climate change and severe weather events have focussed on their impact on the natural environment. However, as identified in the Garnaut Climate Change Review (Heath 2008), '[c]ultural values, such as built heritage, are also likely to be affected by climate change'. The threat that these events pose to the Cultural Built Heritage (CBH) of affected zones is generally limited to individual sites and landscapes. The localised nature of CBH suggests that risk may be mitigated through early identification of impact and targeted strategies for adaptation and conservation, subsequently reducing the risk of damage to, or loss of, non-renewable CBH resources (Sabbioni, Brimblecombe & Cassar 2010).

This paper explores issues related to natural disasters and CBH and presents the idea of disaster preparedness as being integral to CBH protection and conservation. The paper briefly considers some of the elements that form part of the debate surrounding CBH and natural disasters and explores key elements of current scholarship on conservation, before it investigates how the concept of resilience can be integrated into the conservation debate through the notion of adaptive cycles and panarchy. Ultimately, through this paper we aim to reconceptualise CBH and disaster management through the concept of resilience with the aim of building a disaster preparedness and risk assessment framework that can support communities when dealing with the vulnerabilities of their built environment.

BACKGROUND

CBH holds both cultural and national significance, and recovering CBH from natural disasters has individual, social, cultural and national implications. This argument is based upon the perception of CBH as sites of cultural significance that 'enrich people's lives, often providing a deep and inspirational sense of connection to community and landscape, to the past and to lived experience' (Australia ICOMOS 1999: 10); CBH carries a historic, aesthetic, social, scientific or spiritual value for past, present and future generations. Such places of cultural significance represent historical records 'that are important as tangible expressions of […] identity and experience' (Australia ICOMOS 1999: 1), which provide communities with narratives about who they are, as well as about the landscapes that have formed them as collectives (Australia ICOMOS 1999). Restoration of damaged heritage is, however, often neglected in post-disaster reconstruction plans and in the development of disaster mitigation strategies (MacKee 2011, Taboroff 2003, Look & Spennemann 2000, 2001). Disaster management agencies do often not distinguish CBH from the general built environment, and there is great divergence in countries' official interest in incorporating CBH into the activities of the disaster management community (Taboroff 2003). This scenario is commonly worse in developing countries where CBH protection is often way down the list of developmental priorities in normal circumstances.

If CBH is to be successfully integrated into disaster management approaches it must, however, be explored not only in relation to response to and recovery from disasters. It also requires consideration of pre-disaster circumstances, mitigation practices and preparedness as the impact of a disaster will be a reflection of preceding decisions that have been made over an extended period of time. Indeed, understanding risk and vulnerabilities is a key issue when dealing with the impact of disasters on CBH (Look & Spennemann 2001, Taboroff 2003, Spennemann 1999). CBH, which is a vulnerable resource under normal circumstances, is particularly exposed due to the fragile nature of aging structures and the subsequent risk of collapse or legal intervention. At the time of a natural catastrophe, the evolving risks and vulnerabilities of CBH are dramatically increased as issues related to structure and legality are brought together in one devastating event of significant change. This notion of change resulting from natural disasters is at the heart of the argument presented in this paper, which rests upon an integrated and holistic approach to preparedness of CBH for natural disasters.

RESILIENCE

Systems that integrate variables of two co-evolving systems, such as for example socio-ecological systems, convey particularly high levels of complexity (Brekes, Colding & Folke 2003; Berkes & Folke 1998; Walker & Salt 2006). Efforts to understand such complex systems have transpired into the theoretical field of resilience thinking. Holling first developed the concept of resilience in 1973 (Holling 2001) in the field of ecological science. His concept of ecological resilience deals with the structure and function of ecological systems, and he defines resilience as 'the capacity of a system to absorb, utilize or even benefit from disturbances and changes, and so to persist without a qualitative change in the system's structure' (dos Santos & Paridáro 2005: 29). Since then, the concept has evolved and it has been adopted by a number of disciplines, including archaeology, disaster management, urban planning and studies of climate change. Although the concept of resilience has not yet been used in the context of CBH, it can provide a useful lens through which issues related to protection of CBH can be explored. From a resilience perspective, CBH can be understood as a complex system that, in a world of growing turbulence and uncertainty, must be able to absorb disturbances without collapsing.

Understanding the complexity of co-evolving systems—such as the social-ecological system of CBH—and recognising their interrelationships, change dynamics and transformation have provided a rich foundation for looking them from a resilience perspective (Berkes & Folke 1998; Berkes, Colding & Folke 2003; Walker & Salt 2006). At the heart of resilience thinking is the very simple notion of coherence despite change and the idea that to ignore change is to increase vulnerability and forego emerging opportunities (Walker & Salt 2006: 9–10). In resilience thinking, humans and nature are considered as interdependent elements of the one system, which both must be considered when seeking an understanding of the system (Walker & Salt 2006).

Adjunct to this argument is the concept of the adaptive cycle, which has been derived from comparative studies of ecosystem dynamics. The adaptive cycle consists of four key phases: growth or exploration (r); conservation (K); collapse or release (Ω); and, reorganisation (α) (Figure 1). The concept of adaptive cycles can inform studies of cultural heritage conservation, with conservation (K) representing one of the four

distinct phases of socio-ecological system dynamics (Resilience Alliance 2007). Holling (2001: 393–4) explain that there are three key properties that shape the adaptive cycle and the future of a system: the system's inherent potential for change (wealth); the internal controllability of a system; and the system's adaptive capacity.

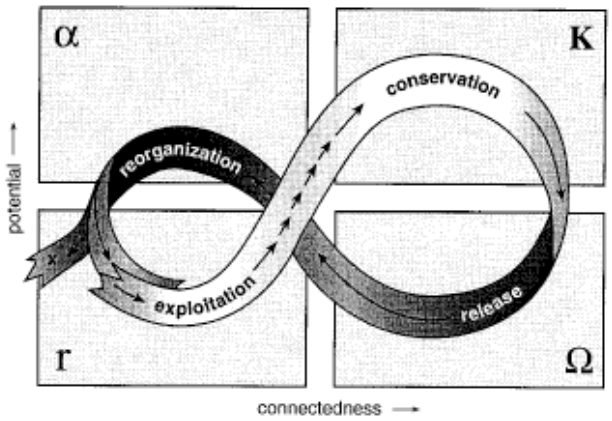

Figure 1: The model of the adaptive cycle (adapted from Holling 2001: 394).

Represented in this cycle are two major phases, often referred to as 'transitions'. The first transition, *foreloop*, runs from r to K. It is characterised by slow incremental growth and movement. The second phase, *backloop*, runs from Ω to α. This is the rapid phase of the cycle, which leads to reorganisation and growth (Holling 2001).

The third dimension of the adaptive cycle is resilience. As Holing (2001: 395) explains, the resilience of a system will shrink 'as the cycle moves towards K, where the system becomes more brittle. It expands as the cycle shifts rapidly into a back look to reorganize accumulated resources for a new initiation of the cycle'. This process is illustrated in Figure 2, which shows the relationship between resilience and adaptive cycles.

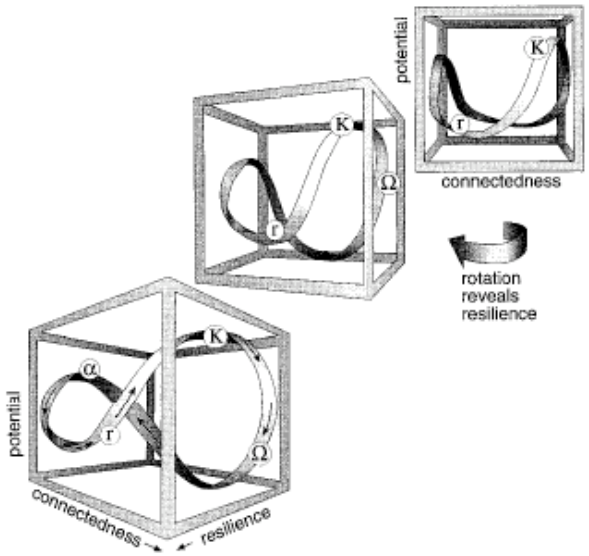

Figure 2: The connection between resilience and the adaptive cycle, with resilience being the third dimension of the adaptive cycle (adapted from Holling 2001: 395)

Understanding and dealing with change is key to Holling's concepts of adaptive cycles and resilience. As such, this theory provides a valuable link to issues related to CBH and natural disasters and it may help address issues related to risk and vulnerability. The ideas of change, transformations and adaptive cycles are notions that are related to how CBH can be perceived through time and explored in terms of general conservation and more specific preparation for potential future disasters. The application of resilience thinking to the conservation of CBH provides an opportunity to explore the persistence and survival of heritage against the ongoing forces of disasters that result in physical, social and natural change. That is, resilience thinking engages in a trans-disciplinary way the dynamic interconnections and interdependencies amongst the key systems. Moreover, it provides a holistic perspective through which issues related to CBH can be explored and a comprehensive approach to the protection of CBH in the wake of disasters can be developed.

LINKING RESILIENCE WITH THE PROTECTION AND PREPAREDNESS OF CBH IN THE WAKE OF DISASTERS

In a discussion of how to build resilience and adaptive capacity in social-ecological systems, Folke *etal*. (2002) identify four critical factors that must exist for the success of a resilient system. These factors, which are summarised in Table 1, include: learning to live with change and uncertainty; nurturing diversity for resilience; combining types of knowledge for learning; and, creating opportunity for self-organisation towards social-ecological sustainability (see also: Folke et al. 2002). They argue that these for factors, which interact across spatial and temporal scales, are required to successfully deal with natural resource dynamics during periods of reorganisation and change.

Table 1: Four critical factors for a resilient system (adapted from Folke *etal*. 2002:)

	Critical Factor	**Description**
1	Learning to live with change and uncertainty	Creating a knowledge base for how to relate to and respond to environmental feedback
2	Nurturing diversity for resilience	Functional diversity and redundancy as per nature
3	Combining different types of knowledge for learning	Integration of knowledge and their sources for a holistic approach
4	Creating opportunity for self organisation towards socio-ecological sustainability	Adaptive co-management by which institutional arrangements and ecological knowledge are tested and revised in a dynamic, ongoing, self-organised process of trial and error

These four factors (Folke *etal,* 2002) provide guidance for developing a framework that can be used when applying the concept of resilience to the conservation of CBH. The first factor would relate to the fact that CBH, as a historical record, has over time endured and responded to environmental feedback that may influence the system in

uncertain and unpredictable ways and place it at the mercy of change. As previously discussed, disasters represent a major moment of change and uncertainty, and for CBH to respond to such change there is a requirement of creating a sound understanding of how CBH as systems can prevent harm from and respond to natural disasters.

Whilst the specific knowledge base that is required to deal with uncertainty surrounding a piece of heritage can incorporate the heritage's unique characteristics with lessons drawn from various sources, the second factor illustrates the unique and complex demands underpinning resilient systems. The factor of nurturing diversity for resilience requires understanding of the specifics of the particular piece of heritage and the diversity of the built environment within which it exists. A requirement for this factor in heritage is an understanding of the conditions of redundancy and obsolescence.

Although understanding of particularities is important, this should not be at the expense of a holistic approach and, as suggested by Folke *etal*. (2002), a resilient system requires the integration of multiple types of knowledge for learning. In the context of CBH this refers to the need for a multidisciplinary approach that incorporates the knowledge and expertise held by the many stakeholders. This is imperative for a holistic approach, which is often lacking in heritage conservation (MacKee 2009). For a system to be resilient it has to hold the opportunity for self organisation towards social-ecological sustainability. In relation to CBH, this factor relies on an understanding of conservation as a sustainable process that builds on the implementation of the appropriate institutional processes, which acknowledge the dynamic nature of cultural heritage and the importance of a suitable management organisation.

Finally this initial proposal for an adaptive cycle that may be used to describe the planning for or conservation of CBH offers an initial framework for the integration of resilience to the preparedness and conservation of CBH in the aftermath of disasters. From these very first steps work needs to focus on the further integration of the four critical factors identified by Folke et al. (2002) (see Table 1). These are important to the success of the integration of resilience and conservation of cultural built heritage. Whilst this theoretical framework might seem quite removed from the initial discussion of conservation theories the notion of adaptive cycles and the theoretical concept of resilience can be applied in both European and Asian contexts through the emphasis on a holistic understanding of the system (CBH) as it sits within its particular geographical, climatic, cultural, social and ecological context.

CONCLUSIONS

This paper has posited an argument for resilience and the concept of the adaptive cycle to support a more holistic and integrated approach for the protection and preparedness of CBH in the aftermath of disasters. The concept of resilience and adaptive cycles provides a theoretical framework that allows, we argue, for an approach that can potentially lead to a functional, culturally relevant, framework for developing mitigation, preservation and preparedness strategies for safeguarding CBH in the wake of natural disasters. Further work is required to fully understand CBH as resilient systems, and also to see how this theoretical framework can adopt various

perceptions of CBH and, subsequently, expand the governing discourse through incorporation of more holistic-systems conceptions.

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SOCIO-ECONOMIC IMPACTS EVALUATION OF SUSTAINABLE REGENERATION PROJECTS IN THE UK

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ABSTRACT

In recent years, sustainable regeneration has been recognised as major socio-economic concerns in the world. In the UK, the government has initiated a number of evaluation methods in dealing with some of the problems associated with regeneration programmes. However, attempts aimed at implementing sustainability have primarily been limited to the evaluation of environmental impacts, with the socio-economic impacts often neglected. While there have been numerous studies on evaluation of regeneration projects in the UK, there has not been any well-defined research that has been able to deal holistically with the broader issues of sustainability impacts to the communities concerned. The study presents the findings of an exploratory study that interviewed six directors of leading construction and consultant organizations involved in regeneration projects in the UK. The findings reveal a lack of early stage evaluation frameworks for socio-economic impact evaluation of sustainable regeneration projects. The results also suggest that the environmental factors of sustainability continue to be the most dominant as compared to the socio-economic factors. This research is drawn from an on-going study for which the general area of investigation is the development of a framework for the socio-economic benefits evaluation of sustainable built environment regeneration projects.

Keywords: Social and economic impacts evaluation, sustainable regeneration.

INTRODUCTION

The concept of sustainable development and regeneration has been an essential focal point of government policy for sometime in the UK and it has contributed to the enhancement of many communities' physical structures (Haran *et al*, 2011). Many of the earlier initiatives that were meant to tackle socio-economic disparities have focused on improving the physical and environmental aspects of regeneration. In more recent times, there have been a number of researches which sought to study and analyze how the UK built environment is responding to the challenges of integrating sustainability into regeneration projects (Dixon, 2006). The Sustainable Development Commission, (SDC, 2003), suggested that the development of regeneration has

proved to be a testing and on-going challenge for government agencies, construction industry practitioners and communities within the UK. The appreciation of such challenges has led to the development of various management strategies and systems to guide and direct industry practitioners to achieve higher and improved sustainability standards. According to Brandon and Lombardi (2011), previous works undertaken on sustainable regeneration have shown that they lack a conceptual clarity related to sustainability assessment. Brandon and Lombardi (2011) identified sustainable regeneration/development as an evolving field and suggested the need for further study as they asserted that there had not been a well-defined evaluation framework developed that was able to deal with the issues of social and economic benefits/impacts and their evaluation in a comprehensive and a decisive manner. Consequently, the quest for sustainable development and the need for better sustainable regeneration outcomes calls for an exploration of new ways of evaluating, at an early stage, sustainable regeneration projects that are under-pinned by strong socio-economic considerations; and which better address sustainability concerns in a holistic manner to maximise the sustainability benefits of these projects.

LITERATURE REVIEW

Sustainable Regeneration a driving force for sustainable development

The post war era has seen a significant number of transformations in the form of regeneration schemes, designed to improve the conditions of areas that have experienced a dramatic decline in their socio-economic fortune (CLG, 2010). A seminal work by Roberts (2000, pg 17) defines regeneration as a *"comprehensive and integrated vision and action which leads to the resolution of urban problems and which seeks to bring about a lasting improvement in the economic, physical, social and environmental condition of an area that has been subject to change".* Roberts' work established the baseline for urban regeneration initiatives and the need to view regeneration activities as an integrated and comprehensive approach which requires a greater balance between the creation of the physical environment and socio-economic development of the communities. Fundamentally, regeneration is about closing gaps (Community and Local Government (CLG), 2010) and tackling the spatial disparities that exist within the communities (HM Treasury, 2007). Yet, the traditional project management approach adopted to deliver such regeneration objectives has accounted for their failure (Sorrell and Holti, (2007). It has also been suggested that many of such regeneration initiatives have been planned without the fundamental components of sustainability as a parallel strand, resulting in the inability of regeneration projects to deliver on such shared objectives underlying sustainable development. The UK government Audit Commission report (2007) has revealed that many regeneration activities are yet to have a consistent and positive impact on most deprived localities. The report suggested that the level of long-term unemployment in the communities where regeneration initiatives have taken place has remained static and targeted work to develop skills and access to employment for these communities still remains under developed. However, to deliver such sustainable regeneration goals as advocated by Roberts (2000) and the UK government report (CLG, 2010) will require a strong and strategic approach to sustainable regeneration development to meet local needs. Since socio-economic disparities are seen to be directly rooted in our community set up, focusing on sustainable regeneration has enormous potential to drive the local communities towards becoming sustainable communities (Smith, 2006). It is believed

that if future regeneration is to make greater sustainable impact on the communities concerned then the current regeneration projects' priorities will have to be altered to reflect the priorities needed to achieve the sustainable development objectives of the affected communities (Raco and Henderson, (2009). It has been suggested that the sustainable regeneration processes which are based on the strategic evaluation plans that are holistic in nature are more likely to drive the sustainable regeneration agenda to achieve the desired sustainable development outcomes for the affected communities (Hemphill *et al,* 2004).

Limitations of the current projects evaluation systems

A plethora of evaluation systems and tools have been developed for the purposes of appraising the environmental and sustainability performance of building projects, in areas such as the use of energy in buildings, indoor environment and building materials containing hazardous substances, etc (Forsberg and Von Malmborg, 2004). While some of these evaluation systems and tools have focused mainly on evaluating the environmental and sustainability performance of the proposed developments, others have placed emphasis on the assessment of their environmental and sustainability impacts (Ding, 2008). The development of these various forms of evaluation methods has largely been informed by the desire to provide building projects with a better profile of environmental performance and the achievement of the best practice in sustainable building design, construction and operation. Yet neither of these evaluation systems has been able to offer such sustainability solutions capable of focusing simultaneously on all the social, economic and environmental aspects of sustainability. Recent work by Brandon and Lombardi, (2011) pointed out that the current lists of available sustainability evaluation methods do not reflect the complexities of issues they were designed to address. A study conducted by CLG (2010) indicated that several attempts to evaluate the impact of regeneration projects to date have been seen to be only partial in their nature. The report went on to encourage practitioners to undertake a vigorous evaluation of regeneration projects and challenged practitioners to be prepared to act on any evidence pointing to a lack of sustainability success. However, a greater demand for sustainable regeneration coupled with the requirement to develop such systematic and multi-dimensional sustainability evaluation models (Ding, 2008), calls for a paradigm shift toward the systems that constitute a satisfactory integrated approach to the evaluation of sustainability impact (Lee, 2006). Such evaluation systems should be clearly set out and define their boundaries and parameters.

RESEARCH APPROACH

In order to meet the objectives of the study, an initial exploration was undertaken through a literature review as a starting point to ascertain the background information relating to the current sustainability practices. A qualitative research design was then adopted with semi-structured interviews used to collect rich data. This approach reflected an interpretivist philosophical position that made use of inductive research strategy and qualitative methodology. A qualitative research approach is considered as an effective method that occurs in a natural setting which enables the researcher to develop a level of detail from involvement in the practice (Creswell, 2009). Initially, 20 leading construction and consultant organisations in the UK were selected, based

on their experience and knowledge in sustainable regeneration projects, through a purposive snow balling sample technique. Formal letters were then sent out to these organisations as an invitation to participate in the study. Follow up telephone calls were also made to these organizations to further explain the purpose and the context of the study. In all, a total number of six (6) organisations agreed to take part in the study. The profiles of these agreed organisations/interviewees are shown in the table 1 below. Face-to-face in-depth semi-structured interviews were then undertaken (between August 2011 and March 2012) with the senior sustainable/regeneration managers of these respective organisations. Each interview lasted for between 40-45minutes. The interviews were formatted around a range of open-ended questions to explore the sustainability issues under investigation. The responses to the exploratory nature of the questions were analysed to identify the emerging themes and issues in the current practices related to early stage evaluation of sustainable regeneration projects.

Table 1: Profiles of interviewees and their leading organizations.

Interviewee	Position	Type of organization
1	Sustainability/regeneration director	Contractor organization
2	Sustainability/regeneration director	Consultant organization
3	Sustainability/regeneration director	Contractor organization
4	Sustainability/regeneration director	Contractor organization
5	Sustainability/regeneration director	Consultant organization
6	Sustainability/regeneration director	Consultant organization

DISCUSSION OF RESULTS

It is widely acknowledged that various contributors in different fields have classified the impacts of sustainability indicators in different ways. However, from a built environment regeneration perspective, the socio-economic aspect of sustainability can be seen as a potential measure of success when implementing sustainability within regeneration projects. The main themes that emerged from the data analysis included sustainability factors, sustainable regeneration objectives/benefits, the evaluation framework and socio-economic impact/benefit. The gap between theory and practice has also been summarized in figure 1 below.

Sustainability Factors

The first interview question put to the interviewees explored their organizations' understanding of sustainability and the importance the practitioners and their organizations attached to such sustainability factors when evaluating project viability. A significant theme that emerged from their responses was the lack of conceptual clarity of what are 'sustainability factors' by the interviewees. All the interviewees provided relatively simplistic definitions and understanding of sustainability in relation to their business operations. Typical of the comments made were as follows:

"Sustainability is something ingrained and inherent in our business processes something that the business has to pay attention to in order to stay competitive…It is about protecting our business from the risks of today and ensuring that we respond to the challenges and opportunities that tomorrow brings…" (Interviewee 5).

"I think sustainability is being one of the key driving forces behind our operations. It has a short to long term benefit to our business. First and foremost it fits with the vision and values of our business. Adopting sustainability makes us competitive in the environment in which we operate…" (Interviewee 2).

The responses highlighted the limitation in the practitioners' perception and understanding of sustainability. The ambiguity of what constitutes sustainability was also identified as a major problem in work done by Brandon and Lombardi (2011)

Sustainable regeneration objectives and benefits

When the practitioners were further asked about their understanding of the main objectives of sustainable regeneration projects, the respondents provided mixed responses. Some interviewees commented:

"…To ensure comfort and safety. To be aware of the social and physical environment and to endeavour to improve the quality of life to residents…" (Interviewee 3).

"All regeneration needs to be profitable otherwise, there's no point doing it, if there won't be any kind of benefit. So without the benefit element, no regeneration happens unless you get a philanthropic developer who just wants to spend millions of pounds to make people happy for things to happen." (Interviewee 1).

Discussing the issues further about the benefits to their organisations and the end-users, most of the respondents indicated that company reputation and profit making was the main benefit for adopting the sustainability principles by their organisations. However, the majority of respondents were of the opinion that issues related to energy usage and in particular cost savings on fuel bills was the main benefit to the end-user.

Evaluation and evaluation framework/mechanisms

In exploring the evaluation mechanisms currently in practice, many of the interviewees indicated BREEAM as being the main evaluation mechanism used for their projects. As some interviewees noted:

"BREEAM is the main assessment method used for our projects as it focuses on low or zero carbon technologies and designs. It is a vital part of our culture and a scheme to promote the adoption of cohesive sustainable solutions across all our specialism as a best practice guide to meet our sustainability objectives" (Interviewee 3).

"…BREEAM is easy to use as it provides a guideline and specifies the environmental impact of the final products. BREEAM ultimate benefits are recognisability of sustainability in the sense that it tends to capture the main environmental aspects of projects…" (Interviewee 4).

Evidence from the interviewees showed that sustainable regeneration practitioners still consider environmental factors to be the most dominant feature of sustainability and they tend to neglect the consideration of any socio-economic factors. Most of the respondents emphasized on the environmental credentials of BREEAM and also

regarded its application as representing the industry's best practice in relation to sustainability. It is worth noting that BREEAM parameters are prescriptive in nature and largely based on quantitative assessment which tends to ignore the processes and issues relating to socio-economic factors of sustainability of the projects. When asked further about just when the evaluation frameworks were being applied during the project life cycle, there were mixed responses. Some of the interviewees noted:

"Ultimately it depends on the nature and duration of the project…We adopt a flexible and innovative approach based on the requirements of the project we are involved in by demonstrating compliance with the specific targets and key performance indicators agreed by all parties on sustainability relating to the construction and operation of the facility…" (Interviewee 4).

In addition, another interviewee who alluded to the use of an evaluation model commented: *"We do not have a structured evaluation framework per se, what we do have is some models for planning and benchmarking…Yes we tend to apply our models throughout our project duration to identify and address actions as soon as possible where the greatest sustainability impact may be available…"* (Interviewee 6).

These responses however revealed the lack of a structured evaluation framework and a lack of an appreciation of early stage evaluation mechanisms for appraising the direct and indirect socio-economic impacts of their sustainable housing projects.

Socio-economic impact/benefit

Finally, when interviewees were asked for their views about the socio-economic impacts of their regeneration projects on the communities, a significant misconception emerged between sustainable regeneration projects, community redevelopment and renewal projects. Although all the respondents interviewed were involved in sustainable regeneration projects, their responses indicated a limited knowledge of socio-economic aspects of sustainable regeneration projects. This was demonstrated by the comments given by some of the interviewees as:

"Remediation of an existing hazardous environment in a sustainable way. Creation of public amenity, the improvement of public access on site and improved existing wildlife habitats that will encourage greater biodiversity on site…Redevelopment of site for use of both commercial/residential and public open spaces" (Interviewee 5).

"It is the social and economic impacts that we find most problematic. Our main goal across all our disciplines is to take a responsible attitude toward renewal of our communities. We are keen on providing modern community facilities, improving the physical environment of our communities as well as safeguarding the environment as a whole for the benefit of our communities" (Interviewee 2).

Many of the interviewees expressed their views in line with the potential environmental benefits of a project and also gave emphasis to sustainability factors that fitted within their own understanding and agenda.

THE GAP AND BARRIERS BETWEEN THEORY AND PRACTICE

Much of the sustainable regeneration literature has shown that the concept of sustainability has not been well understood by many stakeholders within the built environment. The summary of the gap and barriers identified within the exploratory study with the practitioners are presented in figure 1 below. The current gap and barriers existing between theoretical concepts and the 'reality' in practice was amply revealed from the findings as all the six practitioners have consistently emphasized on the environmental credentials to the neglect of the social and economic sustainability aspects of projects. This was evident in the trend of responses in all the main areas explored. Following the exploration of the issues with the practitioners, it is seen that the challenges associated with the current delivery of regeneration projects are direct products of the key players' knowledge, perception and understanding of sustainability. Consequently, this is reflected in the way sustainability has been articulated and applied in practice (see figure 1).

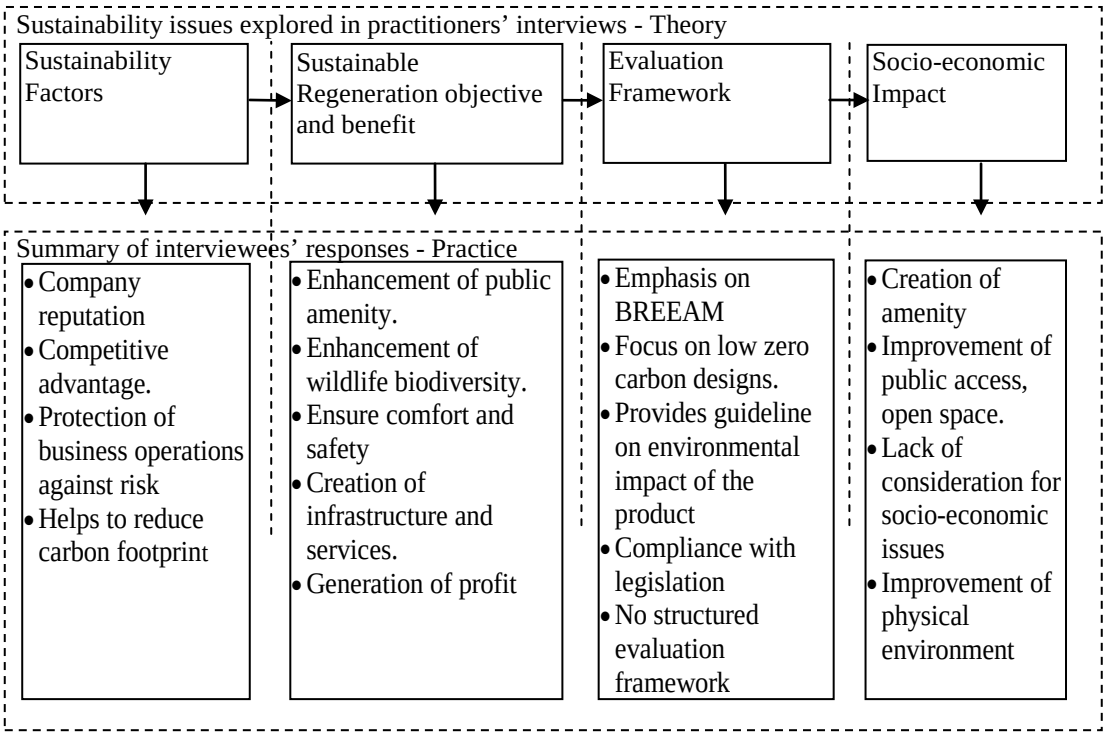

Figure 1. Summary of the sustainability issues and findings

CONCLUSION

The evaluation of socio-economic impacts of sustainable regeneration projects in the UK has been explored through an initial study that used a semi-structured interview approach to collect rich data from practitioners in the field. The study identified a disparity between the theoretical concept and the reality in practice of sustainability factors on a personal and organisational level (see figure 1). The main findings from the study established that the consideration of sustainability was still viewed as being concerned with environmental issues by built environment practitioners to the neglect of the social and economic factors in sustainable regeneration projects. Another major limitation that was identified in the interviews was the lack of any structured

evaluation frameworks or mechanisms for evaluating the direct and indirect impacts/benefits of social and economic outcomes of sustainable regeneration projects. The findings also identified that while all the interviewees seemed to have accepted the sustainability concept in principle; their responses indicated a lack of appreciation of the broader meaning and understanding of the elements of sustainability. The results of this initial study support the need to collect more data from other built environment regeneration projects to enhance the reliability of the findings.

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SUSTAINABLE INTERVENTION PLANS FOR THE IGBO CULTURAL REGION OF NIGERIA

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ABSTRACT

The Igbo cultural landscape region comprises of rural autonomous communities made up of clusters of kindreds and villages until the colonial period when townships were established at about 64 kilometers intervals by the colonial masters for ease of administration. In spite of the existence of townships serving as trade, political and administrative centres for more than one century, the rate of urbanization is very slow. Communities have developed physically, economically and socially at astonishing rates consuming farmlands and traditional community boundaries and causing ecological hazards. The purpose of this paper is to unveil those natural and cultural values and principles of traditional heritage that sustained continuous regional growth solely through community efforts and the consequences of lack of formal regional control in recent times. Wholesome integrated strategies for sustenance of growth in the unique region is proffered. In conclusion, an "adaptive planning" concept which considers the natural and cultural peculiarities, improves on the existing control structure and specifies the performance requirements that ensure effective growth management is recommended for adoption in Igbo cultural region in particular and developing countries in general.

Keywords: adaptive planning, community development, control mechanism, igbo cultural landscape, suburbanization.

INTRODUCTION

Emergence of a new phenomenon in regional growth

The igbo cultural region was traditionally founded on rural autonomous communities made up of clusters of compounds, kindreds and villages untill the colonial period when townships were established. One would think that the townships, after more than one century of existence, would drain the population in the rural areas leaving the rural communities with scanty population of improvised illiterates, farmers, traders, the weak and elderly. But instead the communities have developed dramatically beyond traditional community boundries, destroying rural character and creating ecological hazards since

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the last four and half decades. Today the population has continued to grow on very limited developable land area of about 28, 078km^2. There is a strong rural economy sustained by the steady flow of fund in the region and very strong market system. Hence the new phenomenon- A simultaneous regional growth pattern in which the rural areas aggressively compete with the urban areas and the resultant effect is that the rural areas are wearing urban characters with multiple environmental impacts.

Goals and objectives

The aim of this paper therefore, is to unveil the traditional values and principles of natural and cultural heritage, that sustained aggressive growth while maintaining balanced relationship with nature in igbo cultural landscape region. It will also unveil the interventions that altered the traditional pattern and causes of the ecological hazard within the inherited land constraint and suggest appropriate planning for the region.

Objectives

1. Definition of the igbo cultural landscape region in terms of physical characteristics, gross and net coverage.
2. Determine the inherent regional ecological order including the pattern and distribution of the watersheds, characteristics, resources and settings for traditional order of settlement.
3. Determine the traditional living system in the region and associated social and spiritual needs, order of existence or land use pattern, their interaction with the ecological order, the resultant symbols, nodes, links and landmarks.
4. Determine the traditional agricultural practices and the products including, their natural uses; values in social, nutritional, health and spiritual terms to determine their existence and importance in the traditional economy, the traditional methods of farming on limited and fragmented land since existence and the role of the different products in the economic growth of the region.
5. Determine the traditional regional market system, the market hierarchy, distribution in space, the relative position in the living (spatial) system, economic and social functions, symbolic importance, regional flow of money, the local farm produce, content and sustenance.
6. Determine the traditional principles or measures of conservative importance adoptable with or without modification.
7. Description of the phenominal wholesome growth pattern and the resultant continous suburbanization that defiles the traditional push and pull principle of urbanization.
8. Determine the traditional control and management mechanism and network for conservation, and community development.
9. Determine points of interference with the traditional order and the consequence.

METHODOLOGY

Field studies

The authors carried out levels of studies since 1980 at different parts of the region and at different periods including very busy festivity periods of Easter (March –April), Abroad

meeting and New Yam Festivals (August – September), Christians and New Year (December-January)

- Soil Erosion problems in Ohafia region 1979/80. Subsequent studies on gully erosion in the region were conducted by the authors and other researchers and documented.

- 1984 Igbo Traditional architecture and the living system (pattern of settlement)
- 1985 study on Natural and Cultural adaptations in Igboland
- In 2004, studies were carried out on Traditional Agricultural practices and the Regional market system in Igboland
- 2003 – A. Study of traditional conservation methods as a way of life in Igbo communities.

A. Direct Participation in Community Activities.
The Authors direct participation in community activities as president Generals of their respective communities for four years at the Eastern and central parts of the region.

B. Literature review
Elaborate consultations of books and other relevant publications on the physical Landscape of South Eastern Nigeria were made in addition to field experiences at the different parts of the region using google earth map and physical map of the region.

FINDINGS

1. The Igbo territory covers about 41,538 square kilometers in gross terms and lies at about latitude 7^0 North of the equator. By this location in the humid tropical rainforest region, it has longer period of rainfall (about eight months) and shorter dry season, daily average rainfall of 250mm and an annual average of 3200mm, high humidity of between 80 and 100%, average daily temperature of 80^0F. It occupies the South East central portion of the lower Niger Basin characterized by mosaic Landscape comprising portion of the Niger Delta, Palm belt, Western edge of the cross River basin and the scarplands with such Land forms as hills, plateaus, Valleys, escarpments and ridges at about 330 meters above sea level at the highest points. The hills, valleys, numerous rivers, streams and lakes reduce the developable land area by 20% which is about 28,078km^2 only. Hence the acute shortage of land.

2. The region is drained by Rivers Niger, Imo, Cross River and Njaba as well as numerous tributary streams and all running Southwards to form part of the Niger Delta. The plateaus, terraces and flat plains within the multiple watersheds provided settings for the well drained traditional settlements that metamorphosed into multiple communities enclosed by dense network of vegetation of multi –storey levels. The vegetation is characterized by dark and moist forest floors, dense network of climbers, herbs, thick and tall trunks of hard soft and semi hardwood timber for furniture, bridges, building and railroads and supported wide varieties of wildlife typical of tropical rainforest. The wide range of forest resources provided opportunities for agriculture, traditional medicine, trading, shelter, science, technology and inspiration for arts and crafts.

3. The traditional regional entity can be physically described as covered with multiple units of settlements distributed randomly in the region in conformity with the ecological

order of the respective watersheds. Each settlement or village was founded on well-drained soil and organized in response to the gross scarcity of land and in cluster pattern focusing on hierarchies of open spaces at close proximity providing for the social and spiritual needs of people. The public places constituting landmarks contain symbolic cultural elements/facilities such as halls, shrines, drums, shade trees and markets beyond the scale of the basic compound units. The landmarks which serve as nodes are linked with community routes. The landmarks/open spaces are enclosed with close-to home farms with sustainable vegetable and fruit trees that give the rural character. Each village or kindred over the period matures into autonomous community through spontaneous organic growth process occasioned by competitive community projects. Today there are about 2,500 o fself sufficient autonomous communities in the limited land area. Each community is sustained by, at least, 2 primary schools, secondary schools, commercial schools, skills acquisition workshops, orthodox church parishes (Catholic, Protestant and Methodist), many Pentecostal churches, hospitals or health centres, maternity homes, and community banks, market places and trading activities. The communities are connected through intra and inter community routes. Hence, the complete network of roads connecting the communities, village centers and markets serving as nodes to ensure continuous flow of movement for trading activities and exchange of information in the region.

4. Traditional agricultural practices in Igboland is characterized by

i. Organic Farming through the use of farmyard manure and Livestock droppings particularly in close –to-home farms. Pesticides and herbicides are not applied as the indigenous crops are adapted to the environment. Hence, the products of rural agriculture in Igboland are health foods.

ii. Owner operated holdings: Family members carry out farming on owner operated basis

iii. Small but bountiful: Though the farmlands are small and fragmented, the collective affect at community scale is more than 1000Ha. of cultivated land for wide range of crops at any particular season. The sum total of the varieties of livestock including pigs, goats, sheep and poultry birds at community scale is startling and sustained through maintenance of good local breeds.

iv. Effective intercropping of wide range of relatively adaptable crops is generally practiced

v. Effective integrated farm activities including varieties of livestock, vegetables, cash crops, fruit and vegetable trees, bananas, plantain, snailry, mushrooms etc particularly in close-to home farmlands.

vi. Effective management: Small farm holdings have the principle advantage of effective management in terms of weed, pests and soil conservation.

vii. Regular supplies through regular harvest of crops, vegetables, maize, fruits, nuts, etc. taking advantage of numerous streams, long period of rainfall and moist environment.

viii. Processing of products including drying of fish and meat, multilevel processing of cassava, yams, palmnuts etc. provide jobs and trading opportunities

ix. Food self-reliance: The region produces many varieties of vegetables, processed food and herbs, beverages, vegetable oil and other forest products that sustain the vibrant markets and local demand for delicacies for the regular festivities.

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5. Trading is the traditional occupation of the Ibos who established numerous small scale processing and fabricating technologies with elaborate marketing network. The local economy in the religion is sustained through traditional market system comprising hierarchy of daily, four-day and eight, markets. The eight-day markets are inter-community markets serving multiple communities within their sphere of influence and are the pivots for development and potential regional growth centers (Ekweruo, 2003). As market days vary alternatively traders are always on the move to patronize big markets within their reach. Hence, the highly mobile nature of the Ibos with the markets acting as magnetic forces recycling goods, information and money. Farming has been the traditional complimentary occupation of the Ibos on which trading heavily depends. The rural economy is reinforced by the fact that most of the agricultural products reach the markets in multiple forms. Hence, the multi-level labour and trading opportunities for children, women and men (Ekweruo, 2004).

6. In adaptation to the physical, ecological and climatic peculiarities of the region traditional conservative principles were observed

i. The cluster settlement pattern to conserve land in response to gross scarcity of land resource.

ii. On- site run-off management through effective harvesting of rainwater with detention and retention measures, use of cisterns to collect street run-off and sustainable vegetation cover with the timber, fruit and vegetable trees of evergreen nature in close-to-home farms. The cisterns and the enclosing vegetation help to drain the environment through permeable soils to recharge the underground aquifer. Selective harvesting of forest products and planting of trees help to conserve the green environment

iii. Regular clean up of public places by children and women in turns.

iv. Formation of intercommunity watershed association to sustain regular flow and quality of the streams in the respective watersheds

v. Recycling of organic waste in close-to-home farms to sustain soil fertility and production of health food.

vi. Domestication of trees, shrubs and vines of medicinal and nutritional value

vii. Establishment of bans in close-to-home and distant farms to preserve tuber crops such as yam and cocoyam for subsequent planting seasons:

viii. Creation of educative and recreational environment through designation of common spaces for people in direct relationship with the respective homes, compounds, kindred, villages and communities for spiritual and social needs and for sustenance of cultural heritage of physical, spiritual, educational, economic and recreational importance

7. Young males and females moved to urban areas to learn trading, venture in skill acquisition in areas like tailoring, carpentry, building, machines and automobile repairs, paint production, food processing, block moulding, machines and tool fabrication etc through apprenticeship. With inherited work attitudes, sense of aspiration and entrepreneurship many successfully graduated and established their businesses in their respective communities back home. Trainees and apprentices who graduated within the specified period were established by their masters to become trainers and traders. Hence, the will of progress was established across the region. The strong rural economy is therefore sustained by the steady flow of fund in the region through mandatory and voluntary contributions, rural cottage industries, strong market system, many rural workers and student, churches, service trades, banks, high volume of transportation business, local government headquarters and the enterprising traders, artisans and technocrats who compete traditionally in fund raising, building country homes, factories,

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schools, civic centers hospitals and other life support facilities. **All these, therefore, explain the comparatively slow rate of development in cities and relatively high rate of rural development in the region.**Simple agricultural processing machines were installed for palm produce, cassava processing, maize and beans/cowpea processing in markets, compound spaces or mounted in locally made two-wheel trucks for mobile services. The intercommunity routes connecting the eight-day markets serving as regional nodes produced opportunities for transportation business and employment for drivers and mates. The establishment of local government system with headquarters in selected communities brought employment to rural dwellers and enhanced rural growth.

According to 1963 census the population of the region was about 6,223,831 people and urban population was only 752,884 making up only 12% with 13 townships classified as urban (Ola C.S. 1977). That is to say that the Igbo region is traditionally not urbanized. Today the population has grown to about 20 million on net developable land of 28,078sqkm making the population density about 700 per square kilometer. Urban areas have risen to about 50 suggesting that 37 communities have grown up organically to be classified as township or urban. At the same time villages have metamorphosed into autonomous communities transformed into suburban areas. Many communities coalesced spontaneously to form megacoms (mega communities). It is on the limited land area that the Igbo region have 5 states, 5 capitals, three large commercial cities (Onitsha, Aba, Nnewi), 5 other urban areas or townships, 10 megacoms, numerous suburban areas, about 2,250 autonomous communities and 125 local government headquarters all connected with federal highways, regional roads, rural roads and community roads.

8. The control mechanism in Igbo rural communities comprises the traditional rulers with the cabinet members made up of Chiefs from respective villages and the Town Unions. The traditional rulers are the custodians of culture and tradition and vested with the power of ensuring security. The Town Unions are structured on three levels of male and female wings comprising the central body, the home base union and the village union. Town Unions are responsible for organizing political, social, market and physical development activities, festivities and control of resources, and constitute the fourth-tier government. Branches of the Town Unions are established in cities and foreign countries and they maintain regular links with the Central Bodies to enhance social, health and educational development. Unfortunately, the Town Unions cannot effectively controle the overwhelming rate of development within the last four decades because of lack of professional competence and fund to train physical planners. However, it is noteworthy that the viability of people in Igbo communities is rooted on the decentralization of production, integration of living spaces with cultural and working spaces and community control of resources.

9. The harmonous relationship of people with nature and the sustainable living system established in the traditional landscape was dramatically disrupted during the colonial period. Urbanism took different pattern with alien forms and systems introduced in colonial townships. Deforrestation was massive for timber. Housing took the antisocial grid pattern with extensive linear streets. Gutters lined- up the streets for storm run-off that emptied in lakes, streams, depressions etc. The colonial influence changed the mind-set of people who lost values for traditional conservation of resources and order of social spaces that ensured convivial environment. Hence, the antisocial settings and disruption of ecological balance enhanced scarcity of land, flooding, erosion and loss of serenity established through living with nature.

Results

The issues and consequencies of uncontrolled or unmanaged growth in igbo rural landscape are obvious.

1. The traditional cluster method of housing in compounds which ensured economy in land management, common use of space and conservation of resources was replaced with the anti-social western style houses hence, acute shortage of land and destruction of farm lands.
2. Buildings erected without regards for existing natural order affect flood plains, drainage courses are blocked, air ways blocked and aquifer recharge areas are blocked with ecological consequences.
3. Close-to-home farms with lots of vegetables and fruit trees, vines and herbs that give rural character have given way for massive structures with upto 100% coverage of hard surfaces thereby generating 100% run-off and heat, creates food shortage while traditional herbs go to extinction.
4. Uncontrolled massive building activities have moved beyond close-to-home farms to distant farms to claim farm-land and vegetation at different locations in respective watershed hence, generating run-off and causing deforestation and food shortage.
5. Factories and hauling activities; large volume of cars at weekends and festive periods pollute the environment with noise, fumes and droppings.
6. Over-clearing of sites and establishment of numerous access roads serving unplanned development open the land for erosion, and flooding which affect aquatic life through deposition in water bodies.
7. The continuous high rate of population growth puts a lot of pressure on the scarce land leading to more fragmentation of land and causes social vices.
8. Excessive farming causes soil bleaching while wrong technique of hillside farming causes land- slide.
9. Underground water level is reduced drastically as more water is drawn through the borehole while little recharging goes on because pavements cover recharge areas.

10. Gross ignorance and insensitivity resulting from lack of knowledge of ecological consequencies of unplanned building activities aggravated the issues.
11. Ibo rural landscape which represents one “unique native resources” endowed with wealth of knowledge and comprising tropical vegetation, wildlife, aquatic life, human living system and cultural landmarks is being replaced aggressively with suburbanization and massive erosion to the detriment of future indigenes (Ekweruo, 2003).
12. Absence of efective regional development control created the vacuum in which aggressive indiscriminate development strived.

SUSTAINABLE INTERVENTION THROUGH ADAPTIVE PLANNING STRATEGY

A civilization with its wealth of knowledge established over a period of about 2500 years is experiencing degradation accelerated in the last 30 years since the oil and trade boom. If the present pattern of development continues in the next 50 years a regional conurbaton will emerge with complete destruction of convival rural resources and consequently increased multiple impacts. Hence, the call for appropriate regional landscape intervention plans which must be tackled through“adaptive planning”- a multi-dimensional approach with great sense of purpose. Adaptive planning is a planning strategy that incoporates all thoughts, aspirations, attitudes and values of a particular

society expressed in physical and non-physical forms in the landscape to enhance the socio economic life of the community in the context of the prevailing ecology (Ekweruo 1985). It helps to achieve the planning objective of inducing everybody to participate in the growth process and promoting community involvement in the prevention and control of natural disaster.

SUSTAINABLE INTERVENTION PLANS

A broad issue based 50-year regional cultural landscape master plan must be embarked upon with immediate, short and medium term intervention plans to be reviewed every 5years. Public participation must be wholesome and involves the local residence and indegenes, physical planners, journalists, church organizations, town unions, traditional rrulers, local government authorities, academic insttitutions, women organizations and non governmental organization (NGOs) etc.The elements of the sustainable regional master plan include but not limited to:

A. Education plan

1. Massive public enlightenment/education plan to sensitize the indigenes and other stake holders on the issues and the consequencies. Journalist and churches must be part of the resource agents.

Introduce from next year basic environmental studies in secondary education with emphases on environmental degradation so that the young ones will grow with the knowledge.

2. The general studies programme in tertiary institutions must carry atleast one semester course on environmental degradation and conservation and must be compulsory for all disciplines.
3. Introduce environmental engineering programme to cover erosion,flooding, pollution, and waste management.
4. There must be short training programmes on environmental degradation and conservation for builders, engineers, farmers, civil servants etc.
5. Studies in rural landscape to be included in curricular for centre for environmental studies to be established in different institutions.

B. Physical development plans

1. Inter-state regional rural development plans to harmonize state plans particularly the areas in some watershed

a. Specify standards for coverage of pavements in aquifer and non aquifer recharge areas.
b. Generate plans for rainwater harvesting and specify standards for run-off control for mandatory implementation.
c. Generate standards and regulations for construction of rural roads.
d. Produce forest regulation and regeneration plans to re-establish tropical plants and wildlife threatened to extinction (Longman and Jenik,1978).
e. Develop soil restoration and conservation plans.
f. Encourage and regenerate cloes-to-home farms with vegetable and fruit trees, herbs, spices, vines etc.
g. Develop effective techniques for intensive farming adaptable in the fragmented farm land to boost agricultural production in rural areas (Ekweruo, 2004).
h. Produce rural population growth reduction plans for effective contrrol of population.
i. Develop inter-state water resources development and protection plans.

j. Set the standard for regional based erosion control master plan to be adopted by each state.
k. Concept of extension planners. Each state government in the region to invest on training of landscape architects and town and regional planners with emphasis on environmental engineering to cover erosion and flood control, pollution and waste management, on-site and off-site run-off control etc. The professionals will be employed and posted to local government headquaters from where they will be sent to communities as extension planners.

Summary/conclussion

There is relatively rapid development of special nature in Igbo ccultural region traditionally founded on limited land space and sustainable societal values. The increase in population, volume of unplanned development and unmanaged physical construction in highly fragmented land ownership puts unprecedented pressure on the terrestrial environment hence, deforestation, massive erosion gullies and degradation of aquatic resources. It is also obvious that there is no documentation of similar regional growth pattern in the same context to establish knowledge base.

This study has provided the background or framework on which broad based study can be conducted. The research will continue as knowledge base for wholesome rebranding of regional planning, prevention of further erosion and related ecological harzards, provide strategies for protection of aquifer recharge areas and effective conservation measures for rehabilitation of devastated terrestial and aquatic resouces. While creating opportunity for determining the performance requirements to reinforce the suggested intervention plans efforts will be geared towards mass education to change the negative mindsets and re-establish sustainable value system required for growth management.

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THE INCREASING IMPORTANCE OF ENVIRONMENTAL ATTRIBUTES IN COMMERCIAL BUILDING RETROFITS

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ABSTRACT

Compelling reasons to undertake building retrofit are largely economic and environmental but also social. Retrofit can be less expensive than new build and typically delivers faster projects. Sustainable development is a force for retrofit as the built environment contributes approximately half of total greenhouse gas emissions. Governments search for effective and efficient methods of mitigating the contribution of cities to climate change and building retrofit presents a realistic means of lessening building associated emissions. In Melbourne, the 1200 Building Program is a strategy which aims to escalate commercial retrofits; targeting 1200 Central Business District (CBD) office retrofits by 2020. This research examined all CBD retrofits from 2009 to 2011 to distinguish the nature and extent of retrofits and to ascertain the inter-relationship between retrofits and property attributes. 1422 retrofits were analysed between January 2009 and July 2011. Following an earlier study of retrofits from 1998 to 2008, this research determines whether environmental attributes have become more important over time. The findings support building retrofit in identifiable circumstances and are clearly relevant for increasing built environment sustainability. The research used existing buildings in an international city to ensure relevance to urban settlements where existing buildings can lessen the impact of climate change.

Keywords: Australia, commercial property, refurbishment, retrofit, sustainability.

INTRODUCTION

There is a view that dense cities are an essential component in man-kinds attempts to mitigate the effects of global warming. Furthermore most urban building stock was constructed without consideration of sustainability. In Australia environmental sustainability for commercial buildings became part of the Building Code of Australia in 2006, with minimum standards for energy efficiency applied to new build and some retrofit projects. Acknowledging the importance of retrofits, the City of Melbourne launched the 1200 Buildings Program in 2008 to deliver carbon neutrality by 2020 after Arup (2008) concluded 1200 retrofits would deliver a 38% reduction in greenhouse gas emissions. This research examines whether there has been a shift by assessing the importance of environmental attributes.

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Building Retrofit

Multiple attributes are important in retrofit and are categorised as economic, location and land use, physical, legal, social and environmental. Although costs can be traded against social and environmental gains, retrofit has to be economically sustainable (Kincaid 2002). Based on whether the intention is to occupy or lease, different features are more or less important. Owner occupied stock had higher levels of adaptability criteria compared to speculative designs (Arge 2005) and a greater return on investment over the whole lifecycle, whereas positive user demand and active marketing by stakeholders were important in the reuse of vacant stock (Ball 2002).

Pre and post retrofit value is a success indicator and one Hong Kong study found a positive relationship between retrofit and value (Chau et al. 2003). Another economic indicator is vacancy rates (Ball 2002). Depending on condition, quality can be increased (Kersting, 2006) where quality is measured by amenity features, services, fixtures and fittings. Whilst it is possible to increase quality, rental and capital value; the capacity to upgrade depends on condition and location (Snyder 2005). Total costs are important in retrofit (Davis Langdon 2008), typically at around 66% of new build costs. However where buildings are complex, heritage listed, and or have deleterious materials retrofit costs can surpass new build.

The physical building determines whether retrofit is possible and desirable and all studies identified age as important (Ball 2002). Some buildings feature construction forms and materials making retrofit more expensive or challenging because of compliance issues. Height, construction type, and frame condition was important (Gann & Barlow 1996) with steel frames being more adaptable because of the ease of cutting into beams (Kincaid 2002). Floor size was significant in London retrofits where buildings with unusual floor plates or sizes were more difficult to adapt and suited a limited range of users (Kincaid 2002). The location of the services core was significant in Snyder (2005) affecting the sub-division of space. A central location gives greater scope for sub-division whilst minimising corridor and circulation space. Whether a building is detached or attached affects the ease or desirability for retrofit. With less attachment contractors work faster and cause less disruption to users (*Isaacs* in Baird et al. 1996). Access or, the number of entry and exit points affects retrofit potential across a range of property types (Ball 2002). Studies established optimal benchmarks for building width in retrofits between 15 to 17 metres (Arge 2005) and showed these buildings could accommodate a range of space configurations and user needs more frequently. Similarly the distance between the structural columns affected the ease of retrofit for new and other uses (Arge 2005). Floor strength is vital (Kincaid 2002) and has to be assessed to determine the land uses which are possible and suited physically; it is not possible to accommodate office use in a building with floor strength of 3kN/m², unless strengthening or replacement is undertaken. The technical grid and services equipment is significant and whether the building can accommodate extra capacity (Arge 2005) for example, raised floors allowed for IT cabling to be upgraded easily. Modularity refers to modules which can be rearranged or interchanged and 'plug and play' allows for a fast change of layout, change of services and wall systems (Arge 2005). Buildings which offer scope for extension are more adaptable (Arge 2005). Other attributes were form and organisational space and ease of compartmentalisation.

Location is considered in terms of proximity to public transport which is environmentally positive. The amount of on-site parking is significant where little or no public transport is available (Douglas, 2006). Land use attributes are important (Arge, 2005) where existing use affects the potential for a new use. The existing planning zone determines legally permissible development, though it is possible to have sites rezoned. Swallow (1997) concluded that retrofit is affected by tenure because it affects the funds the party is willing to invest. An owner has an interest in perpetuity whereas a lessee's interest lasts for the lease term. Institutional owners invest to maximise the return on investment and probably use professional consultants to advise on retrofit. Private owners may or may not use professional consultants and may reside overseas. They may hold property for many reasons, such as future development or for rental income or capital growth and may engage in less retrofit; though this is unknown.

Retrofit is affected by building occupation. With single tenants when the lease expires there is opportunity to adapt, however, with multiple tenants, it is unlikely all leases expire simultaneously and the building may be partly empty (and not income earning) before the building can be retrofitted. Historic listing protects architecturally or socially significant buildings for society (Ball 2002). Heritage retrofit can be more expensive because of costs in using traditional materials, techniques and craftspeople. There is benefit in proactive policies and legislation in building retrofit (Snyder 2005) and research on London and Bristol docklands found proactive policy and legislation enhanced the retention of existing stock (Bromley et al. 2005). Hostile factors such as noise are less desirable and can adversely affect retrofit. Deleterious materials, such as asbestos, are hostile factors. Hostile factors present social and economic barriers driving up costs. Some buildings have a social stigma making retrofit problematic, for example mental asylums had negative emotions associated with the prior use (Binder 2003).

The scope and extent of environmental aspects of retrofit has increased (Kincaid 2002). There is an overlap with social, economic and location aspects, i.e. proximity to public transport provides environmental, location, economic and social benefits; where attributes can be interpreted on multiple levels. The most significant environmental impact of buildings is the greenhouse gas emissions associated with energy use (Douglas 2006). Buildings, assessed under recognised environmental assessment methods have met specified standards in a range of environmental criteria including energy use. Retrofit offers a chance to reduce energy and water use and to recycle, harvest and re-use water. The transport occupiers use affect sustainability (Davis Langdon 2008). Public transport has less environmental impact and emissions than private cars, and proximity to public transport is positive (Davis Langdon 2008). However car-parking is desirable in the Property Council of Australia building quality grading matrix and represents a paradox in market perceptions of quality and the perception of environmental features. Sustainability was mandated in the Building Code of Australia in 2006 and the research covers the period from 2008 to 2011, where the influence of environmental attributes remains to be seen.

Research methodology and design

Analysing decision making with regards to building retrofit is multifaceted (Wilkinson & Reed, 2011) and many found the precise classification of the attributes influencing retrofit difficult to identify and subjective. This study adopted an

approach previously used where a database of retrofits and attributes determined important attributes (Wilkinson & Reed, 2011). Advantages are that a large number of retrofits can be studied and that it does not rely on subjective views. Much research uses a case study approach with small samples of buildings (Kucik 2004, Arge 2005). Using the criteria identified as important in these studies, the researcher designed and populated a database. The approach is different due to the detailed volume of data and method used. Identified retrofit criteria formed the fields for the database. The sources used included the Building Commission of Victoria Building Permit database and 'Cityscope' database. Commercial data from the Property Council of Australia (PCA 2007, PCA 2008a) and visual inspections completed the database. As every retrofit was recorded in the Building Permit database a census approach was adopted; 1,422 retrofit events. The variables were coded physical, social, legal, economic and environmental. The research aimed to examine retrofits in a mature commercial market and the Melbourne CBD in the form of the original street grid set out by Hoddle is a distinct geographical location, occupied since 1834.

Principal component analysis (PCA)

PCA is a reliable technique of weighting dimensions in cross sectional data (Horvath 1994) having the ability to reveal, untangle and sum up configurations of connection within a dataset. From a number of original variables PCA reduces data into a smaller set of new merged factors with the least loss of information (Hair et al. 1995). The aim was to ascertain the highest level of variance explained by an interpretable group of factors and all attributes were appraised. All variables were input into the PCA to generate a lesser number of components where factors with Eigenvalues exceeding 1.0 were retained. The factors were rotated using an oblique 'Oblim' rotation method; the result being a table of specific factors which includes the loadings of single building attributes. Works were classified as minor works, alterations, change of use, alteration and extensions, new build and demolition. 'Alterations' accounted for 1275 retrofits, 89% of all events. To determine meaning the researcher interprets the pattern of the factor loadings; a subjective process (Hair et al. 1995). Following an analysis of the loadings across the factors the minimum threshold was 0.5 recommended by Tabachnick & Fidell (2001). With the list of each factor containing high loading building attribute variables, the researcher assigned factor names. This analysis examined all events classed as 'alterations' the second most extensive degree of retrofit in the study and coded as level 2. For the retained property attributes the Kaiser-Meyer-Olkin (KMO) score and Bartlett test are shown in Table 1.

Table 1 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.606
Bartlett's Test of Sphericity	Approx. Chi-Square	1621.785
	df	45
	Sig.	.000

The KMO of 0.606 exceeded 0.50 and with the significance less than 0.05, the PCA was continued. A total of ten property attributes were analysed and produced a ten factor table (table 2).

Table 2. Total variance explained PCA 'alterations' retrofit events

	Initial Eigenvalues			Extraction Sums of Squared Loadings		Extraction Sums of Squared Loadings	Rotation Sums of Squared Loadings[a]
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	3.162	31.622	31.622	3.162	31.622	31.622	2.859
2	1.479	14.788	46.411	1.479	14.788	46.411	1.414
3	1.358	13.577	59.988	1.358	13.577	59.988	2.072
4	1.001	10.011	69.999	1.001	10.011	69.999	1.127
5	0.949	9.495	79.494				
6	0.755	7.552	87.046				
7	0.520	5.203	92.249				
8	0.395	3.952	96.202				
9	0.232	2.319	98.521				
10	0.148	1.479	100.000				

Extraction Method: Principal Component Analysis.
a When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

Four factors of attributes had the highest effect on building retrofits between January 2009 and July 2011. After the initial extraction using 42 variables, the reduced variables retained for 'alterations' retrofits were: vertical services location, number of storeys, PCA grade, NABERS rating, type of construction, Green Star rating, parking, historic listing, street frontage and aesthetics. The first heading shows the variance explained by each of the ten variables. Four components explain 69.99% of the original variance. The third section shows the Eigenvalue of each of the four rotated components, as the components are correlated with each other there is some overlap in the variance explained by each factor. For the rotated solution the factor loadings and correlations are given in the table 2. Table 3 shows the four components for this PCA.

Table 3. Pattern Matrix[a] for Level 2 retrofit events.

Property Attributes	Environmental / physical (Factor 1)	Social / physical (Factor 2)	Physical (Factor 3)	Environmental (Factor 4)
PCA grade	**0.89**	-0.06	-0.02	-0.20
NABERS	**0.82**	0.33	0.18	0.16
Aesthetics	**0.78**	-0.28	0.03	0.01
Number of Storeys	**-0.63**	0.10	0.46	0.07
Historic listing	0.20	**-0.76**	-0.24	-0.12
Construction type	0.00	**0.52**	-0.13	-0.22
Parking	-0.31	**-0.51**	0.37	-0.25
Street frontage (metres)	0.10	0.20	**0.96**	-0.04
Vertical services location	-0.01	-0.21	**0.62**	0.03
Green Star rating	-0.06	-0.07	-0.05	**0.95**

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.
a. Rotation converged in 9 iterations.

Results

In component one the attributes Property Council of Australia building quality grade, NABERS rating, aesthetics and number of stories are all highly or very highly loaded on component 1 (table 4). The variables explain 32% of the original variance where component one has four attributes, the first three relate to sustainability (environmental and social) and the fourth relates to property height (physical). It is possible to refer to these attributes as 'environmental and physical'. Aesthetics is loaded on component one and relates to appearance indicating that buildings of poor appearance are less likely to be adapted. The final variable 'number of stories' is strongly and negatively loaded and relates to physical dimensions of the building.

Three attributes loaded high on component two; historic listing, construction type and parking (table 3) and explained 15% of the variance. In component two attributes were influenced by social and physical factors. Historic listing applies to the social values or characteristics. Construction type and the provision of parking relates to physical attributes. Historic listing limits to some degree the level of work which any owner or user can undertake. Parking is negatively loaded.

In component three, attributes street frontage (building width) and vertical services location are very strongly and moderately loaded, explaining 14% of the variance (table 3). The attributes can be described as physical and relate to the size and dimensions of the building and flexibility in terms of space configuration. One attribute green star rating is very strongly loaded on component four and explained 10% of the variance (table 4). The attribute measures the provision of an environmental rating for a floor or a building. The variable is described as environmental. Table 4 summarises the main PCA component categories and the component names ascribed by the interpretation.

Table 4 Summary of Level 2 alterations PCA Component Categories.

Component number	Component name	Component attributes
1	Environmental and physical (32%)	Property Council of Australia building quality grade (29%) NABERS rating (26%) Aesthetics (25%) Height (number of storeys) (20%)
2	Social and physical (15%)	Historic listing (42%) Construction type (29%) Parking (28%)
3	Physical (14%)	Street frontage (60%) Vertical services location (40%)
4	Environmental (10%)	Green Star rating (100%)

CONCLUSIONS

'Alterations' retrofits, the second level of works, had the highest number of events, showing that Melbourne office building owners were more likely to engage in this type of retrofit from January 2009 to July 2011. Although it covered the period immediately following the Global Financial Crisis of 2008, 1422 events occurred, around 46 events per month. 'Alterations' retrofits are undertaken when leases expire and new tenants move in or to refresh spaces to attract new tenants to maintain the low vacancy rates. When all building permits were analysed, commercial buildings accounted for 55% of all work in the CBD, followed by retail at 29% therefore the City of Melbourne are targeting the sector which currently is the most active and has

the potential to deliver the highest level of emissions reductions. The 1275 alterations retrofit events were analysed in the PCA because at least 100 cases or five times the number of attributes are required to undertake a reliable PCA (Jackson, 2003). As there were 42 attributes to analyse the minimum sample size would be 210 and only the 'alterations' satisfied this criteria. The results show that ten attributes group into a four components and account for 69% of variance in retrofit. This is a reasonable degree of importance for a small number of attributes and the 32 attributes which were removed account for the 31% of importance in retrofit.

The results of the alterations PCA shows that two environmental attributes, the rating tools NABERS and Green Star are important in building retrofit at a minor level and this is a major change from the earlier study (Wilkinson & James, 2011). The property attributes do not group together in a neat pattern, i.e; physical attributes pair with environmental and social attributes in one component. Previous studies had simplified the groupings of attributes based on logic rather than a quantitative process. The PCA overcomes this, using a quantitative objective method and a large sample . Physical attributes featured in three of the four components and show that the physical attributes remain important; however other attributes such as social and environmental are included. Whilst economic attributes did not feature greatly it is possible to interpret the Property Council of Australia building quality grade as an economic attribute as well as an environmental one. Similarly the provision of parking and an historic listing could enhance a building's capital and rental values. The research questions were; (a) *are environmental attributes are important in office retrofit?* and; (b) *where is the sustainable office retrofit market trending?* This analysis shows, environmental attributes were important in alterations retrofits in the Melbourne CBD between January 2009 and July 2011. The NABERS rating tool accounted for 26% of the importance within component one. In the fourth component the environment attribute Green Star accounted for 100% of importance within the component. The second research question asked where the sustainable office retrofit is trending and on the basis of this analysis it would appear the Mandatory Disclosure legislation of 2010 requiring owners to disclose energy rating at the point of lease or sale is having an effect where more buildings are rated. It is likely that this will continue as more leases expire over the coming 4 year period and the opportunities for sustainable retrofits present themselves to building owners.

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AN ASSESSEMENT OF THE IMPLEMENTATION OF QUALITY CULTURE IN CONSTRUCTION

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ABSTRACT

The abstract text should not exceed over 200 words. The font set at Times New Roman 10 point for the abstract body and keywords only. A strong quality culture has been recognised as an important prerequisite to the achievement of sustained competitive advantage to deliver products and services that can meet customer needs and satisfaction. The study attempts to assess the implementation of quality culture in the Nigerian construction industry. A total of 200 structured questionnaires were administered with 45% response rate. Mean statistics and analysis of variance techniques were used for data analysis. Respondents were asked to assess the factors of quality culture implemented in their respective organisations. The findings of this survey revealed that leadership and top management commitment is the highest ranked factor implemented while customer management/focus and suppliers' partnership and communication followed. The least factors implemented are training and education, reward and recognition and quality planning. ANOVA test conducted among the three groups of respondents (client, contracting and consulting organisations) revealed that out of the fifty factors of quality culture tested; thirteen factors differ significantly in their mean scores. It is recommended that cultural audits, extensive awareness and training programs should be initiated and or reemphasized to improve understanding and increase willingness and commitment in implementing quality culture.

Keywords: construction industry, factors, implementation, Nigeria, quality culture.

INTRODUCTION

Construction impacts the quality of life for building facilities and plays a major role in a nation's economy and development. According to Farooqui, Masood and Aziz (2008) construction sector is globally considered to be a basic industry on which the development of a country depends. To a great extent, the growth of a country and its development status is generally determined by the quality of its infrastructure and construction projects. According to Jackson (2004), quality is contained in the tripod of construction management; it does not only impact appearance and durability but also the performance of a project. Performance evaluation in construction project generally focuses on a limited number of performance elements which is the act of

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fulfilling the project goals related to the product, which are completing the project on time, within budget and with the required quality and to client satisfaction (Blismas, Sher and Thorpe, 1999; Egemen and Mohamed, 2006). Nowadays, both from public and private sectors place more emphasis on the quality of products rather than the cost and time which was the major concern in the past (Abdul-Rahman, Wang and Yap, 2010). Therefore, in order for construction clients and end users of completed facilities to realize best value, the concept of quality culture must be stressed in the industry to improve the quality of product and services (Idrus and Sodangi, 2010). The willingness to change the quality culture and the commitment of top management towards quality will determine the success of total quality management in the industry (Zeynep, Arditi, Dikmen and Birgonul, 2008). Quality and efficiency have been identified as the major imperatives lacking in Nigeria's construction industry. From a general knowledge, a number of construction firms in Nigeria under-pay their workers, with this poor salary package "quality might never be ingrained in culture". Construction labours tend to focus more on the number of hours worked and quantity of work done rather than the quality of work executed. In regard to this, all stakeholders involved in construction projects have a role to play in order to deliver a quality product. On this note, this study sets out to assess the implementation of quality culture in the Nigerian construction industry.

LITERATURE REVIEW

According to Hoonakker (2011) clients demand improved service quality, faster buildings and innovations in technology. Improving quality of construction is the easiest way to improve the industry. Culture is a complex issue that essentially includes all of a group's shared values, attitudes, beliefs, assumptions, artifacts, and behaviors, to the extent that members are not even aware they are influenced by it (Tharp, 2009). The concept of culture is difficult to be expressed explicitly; instead, it can be sensed, felt and perceived (House et al, 2002). According to Harvey and Stensaker (2008) being shared means that it is a social phenomenon that is learned and involves arbitrarily assigned, symbolic meanings. In this regard, culture is ingrained in believes and values. Typically, the construction industry has a culture, that is, shared understandings about what is expected, by all participants, in the way relationships are conducted between participants in the construction process (Rowlinson and Root, 1996). It is not only the final product that is subject to criticisms but the processes, the parties, the materials etc., are under tremendous pressure for better quality in construction (Mahmood et al 2006 ; Sodangi, Idrus and Khamidi, 2010). Failure of any of the parties will seriously affect the quality of the final project (Sodangi et al., 2010). The construction industry tends to define quality as the ability of products and processes to conform to the established requirements and specifications (Arditi and Gunaydin, 1997; Mahmood et al. 2006). Quality is a persuasive concern throughout the entire construction project process, as the performance of each phase in the process will affect the performance of next phase (Sodangi et al., 2010). Quality may perhaps serve as a measure of client satisfaction, project and contractor's performance. Contractors often perceive total quality management as an extra cost, but they do not realize that it is not the quality that costs but rather the non conformance to quality that is expensive (Pheng and Teo, 2004). Sodangi, et al. (2009) posited that a strong quality culture continuously delivers high quality products and services are an important prerequisite to sustained competitive advantage. Hence, rather than understanding culture and quality as independent entities, it is important to understand that quality actually stems from a broader

cultural perspective (Harvey and Stensaker, 2008). However, the quality culture of an organisation is a subset of an organisation's overall culture (Cameron and Sine, 1999).

Elements of quality culture

The goal of organisations is to create a culture of quality across the entire project site, get the job done right, the first time and every time (PHCC, 1996). From the stand point of Stark (2011) total quality is a description of the culture, attitude and organisation of a company that aims to provide, and continue to provide, its customers with products and services that satisfy their needs.

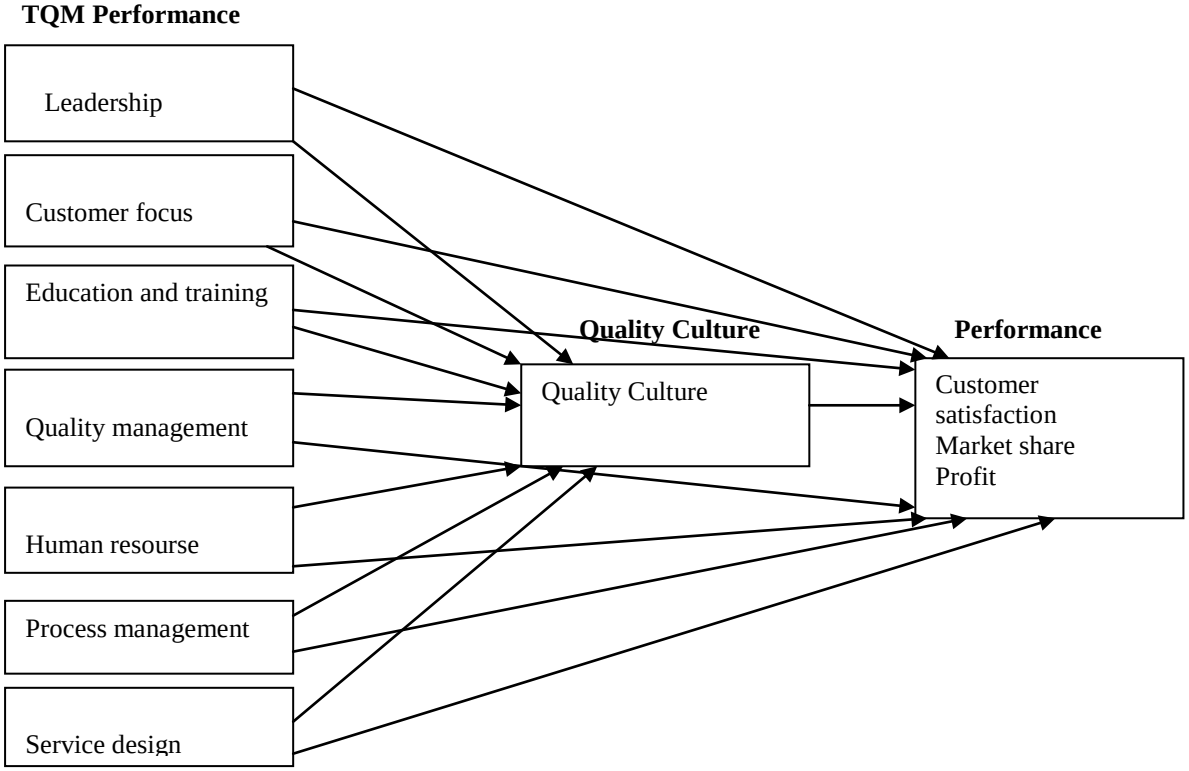

Figure 1: Theoretical model (Source: Mojtahedzadeh and Arumugam, 2011)

There is a consensus among professionals and researchers that the solution to quality problem lies in total quality management at all levels of design, procurement and construction (Sodangi, Idrus, and Khamidi, 2010). However, quality culture does not change in a short time because for changing this factor, the company needs a long-term process (Mojtahedzadeh and Arumugam, 2011). Figure 1 demonstrates the relationship that exists between the elements of total quality management (TQM), quality culture, and performance. The elements of quality culture in the report of Mahmood et al., (2006) are the success factors of total quality management in most total quality management literatures. From this review it can be postulated that:

$$\textbf{Quality culture} = f\ \textbf{(TQM factors implemented)}$$

Bason (2011) asserts that total quality management (TQM) is reached when a culture of quality is established and becomes entrenched at all levels of an organisation. A number of researchers have identified several factors for the successful implementation of total quality management in both developed and developing nations. Some of these factors are discussed in the works of Baidoun (2003, 2004), Al-Jalahma and Gallear (2010), Haupt and Whiteman (2003); Lam, Wang and Lam (2008); Pheng and Teo (2004); Sebastianelli and Tamimi (2003). There are ten (10) important elements of quality culture which TQM practitioners generally agree should

be present in organisations whose culture complements TQM implementation and these according to Mahmood et al. (2006) include leadership and top management commitment, customer's management, training and education, teamwork, people management, and empowerment, supplier partnership, quality planning and strategy, process management, rewards and recognition and effective communication.

RESEARCH METHOD

A sample of 200 was chosen from contracting, consulting and client organizations in Lagos State. Lagos was chosen because of its commercial nature and being a state with array of construction sites and concentration of construction companies. The target population consisted of various construction practitioners. A survey questionnaire was designed to elicit information on a list of 50 factors - classified into ten categories - obtained through literature review. The respondents were required to choose from a scale of 1 to 5 representing 'not implemented' to 'very highly implemented' respectively. Data analysis process was carried out using statistical tools such as frequency tables, mean and analysis of variance (ANOVA). A total of 89 questionnaires were received from the respondents which represents 45% response rate. The demographic data revealed that senior staff constituted the highest proportion (39%), site engineer 15% and project manager (15%) Quality control officer (10%), while the least percentage included Managing Director (5%), construction manager (4%) followed by partners (5%) and assistants (7%). The respondents are professionally qualified. Corporate members accounts for 66% of the respondents while 2% of the respondents are fellows of their professional institutes. Organisational distribution includes 42% consulting firms, 40% contracting firms and 18% of client organizations. Ownership structure of respondents indicates that 82% of the organisations surveyed are predominantly large and medium sized companies.

PRESENTATION AND ANALYSIS OF DATA

Factors determining implementation of quality culture in construction work

The analysis of factors used in assessing quality culture is presented in Table 1; top managers' act as role model for quality culture is the factor with the highest mean score (3.88); this is followed by quality is not compromised for productivity with a mean score of 3.71, closely followed by communicating, motivating, supporting people and encouraging effective participation having a mean score of 3.69. The least factor implemented was authority is equal to responsibility (3.44). At present, it is safe to infer that these factors are presently being significantly implemented in the Nigerian construction industry. **Customer management (Focus);** high technical competences of workforce and quick response to owner / customer's request (3.67) stand to be the highest ranked, while the least sub factors implemented are good appearance of jobsite and good appearance and conduct of workforce (3.39). This result shows that the industry is achieving quality on the technical competence of workforce. **Training and Education;** from Table 1 on the job training (3.55) and in-house sessions for quality (3.37) were the top factors implemented for training and education. However, training of subcontractors and suppliers (2.35) and International training (2.44) were the least ranked revealing less implementation. This indicates that on the job training and in-house sessions for quality is the major training available to majority of construction work force. **Team work;** result indicates that key players in construction are involved at the inception of construction works (3.51) and they are

enthusiastic about change (3.28). Rewards and recognitions to reinforce teamwork was the least with a mean score of 2.92; this is a relative quality implementation.

Table 1: Assessment of the implementation of quality culture in construction

Factors	Sub factor code	R	Mean	Overall Mean
Leadership and top management commitment	Top manager act as role model for quality culture	1	3.88	3.55
	Quality is not compromised for productivity	2	3.71	
	Elimination of zero defect (do it right the first time) slogan by leaders and top managers	4	3.53	
	Eradication of training by top managers	7	3.18	
	Provision of training, working tools, machinery and materials	5	3.46	
	Authority is equal to responsibility	6	3.44	
	Communicating, motivating, supporting people and encouraging effective participation	3	3.69	
Customer management (Focus)	High technical competence of workforce	1	3.67	3.50
	Good appearance of job site	6	3.38	
	Good appearance and conduct of workforce	5	3.39	
	Quick response to owner / customers request	2	3.56	
	Safe operating procedure	4	3.46	
	Minimal occurrence of accident on job site	3	3.55	
Training and Education	On the job training	1	3.55	2.91
	In-house sessions for quality	2	3.37	
	Training of supervisors and hourly paid workers	7	2.80	
	International training	9	2.44	
	Seminars / workshops on quality	6	2.84	
	Training on statistical process control tools (SPC tool is a prescribed recipe for quality improvement)	8	2.56	
	Technical education in construction	5	2.91	
	Training of subcontractors and suppliers	10	2.35	
	Management training	3	3.24	
	Team training	4	3.02	
Team work	Key players enthusiasm for change	2	3.28	3.22
	Involvement of key players at the inception of construction work	1	3.51	
	Rewards and recognitions to reinforce teamwork	4	2.92	
	Team approach (such as quality circles ,cross functional teams) in problem solving and continuous improvement	3	3.17	
Suppliers partnership	The choice of suppliers is based on quality rather than price	2	3.21	3.30
	Promotion of the concept of customer/supplier relationship	3	3.16	
	Long-term relationship and working partnership with key suppliers	1	3.52	

Table 1: Assessment of the implementation of quality culture in construction (cont'd)

Factors	*Sub factor code*	*R*	*Mean*	*Overall Mean*
Process management	*Documentation of the quality process*	1	*3.47*	*3.16*
	Assign a process member to be responsible for the execution of each construction process	3	3.20	
	Use of statistical analysis tools in managing quality process (e.g. measurement of rework cost ,waste ,materials etc)	4	3.02	
	Establish measures and target to be used as evidence of the success of attaining customer values attached to the process team	2	3.21	
	Recognize and reward individual contribution to the process team	5	2.89	
Quality planning	Set up a quality committee/council to provide strategic direction to quality plan	2	2.87	2.88
	Integrating total quality management (TQM) into all planning	1	2.91	
	Development plans for handling non –conformance to quality	2	2.87	
Reward and recognition	Reward for result (quality of work done)	1	3.08	2.91
	Compensation is equitable	3	2.88	
	Job security of employee	2	2.93	
	Set up recognition and reward programmes (monetary and non-monetary) to maximize employees support and involvement in the attainment of quality	4	2.75	
Communication	Effective top down, down top management communication	2	3.35	3.30
	Communicating mission and vision statement to employee	1	3.44	
	Communicating success and progress of project /activities between management and employee	3	3.41	
	Elimination of communication barrier among employees and top management (which could be as a result of cultural values, mindsets of the top management or employee)	4	3.00	
People management and empowerment	Employee fulfillment(employee being proud of their work)	1	3.36	3.12
	Employee are recognised for superior quality performance	2	3.31	
	High level of participation in quality decisions by non-supervisory employees	3	3.03	
	Top management pushes decision making to the lowest practical level	4	2.78	

Suppliers partnership; According to the result presented in Table 1 long-term relationship and working partnership with key suppliers ranked first (3.52). This is followed by choice of suppliers is based on quality rather than price (3.21) while promotion of the concept of customer/supplier relationship (3.16**)** was the least. The mean ratings of these sub factors show that suppliers' partnership has been implemented but not highly implemented. **Process management;** The result revealed

that documentation of quality process (3.47) and establish measures and target to be used as evidence of the success of attaining customer values attached to the process team (3.21) were ranked first and second while recognise and reward individual contribution to the process team dropped from being averagely implemented with a mean score of 2.89. **Quality planning;** the factors under quality planning in Table 1 dropped from being averagely implemented on a five point scale. In the order of ranking, integrating total quality management (TQM) into all planning (2.91), set up a quality committee/council to provide strategic direction to quality plan (2.87) and development plans for handling non –conformance to quality 2.87. This is an indication of lack of planning for quality in the Nigeria construction works. **Reward and recognition;** reward for result on quality of work done (3.08), and Job security of employee (2.93) were ranked first and second for reward and recognition in the table. On the other hand, set up recognition and reward programmes (monetary and non-monetary) to maximize employees support and involvement in the attainment of quality was least ranked with a mean score of 2.75. Apparently, these factors are approximately 3.00 on the likert scale, thus, it can be concluded that their level of implementation in the industry is not sufficient enough to achieve the benefit of total quality management. **Communication;** communicating mission and vision statement to employee (3.44) was ranked first followed by effective top down, down top management communication (3.35), communicating success and progress of project /activities between management and employee (3.41) was ranked third while elimination of communication barrier among employees and top management (which could be as a result of cultural values, mindsets of the top management or employee) was ranked fourth with a mean score of 3.00. Presently, these factors are treading on the path way of quality culture implementation. **People management and empowerment;** based on the experience of the respondents, employee fulfilment (employee being proud of their work is being implemented in the industry with a mean score of 3.36 this is followed closely by employee fulfilment (employee being proud of their work) with a mean score of 3.31, top management pushes decision making to the lowest practical level was the least with a mean score of 2.78. Generally, these factors are being averagely implemented in the construction industry.

Table 2: Summary implementation of quality culture in construction work

Factors	Mean	Rank
Leadership and top management commitment	3.55	1
Customer management(Focus)	3.50	2
Supplier partnership	3.30	3
Communication	3.30	3
Team work	3.22	5
Process management	3.16	6
People management and empowerment	3.12	7
Training and Education	2.91	8
Reward and recognition	2.91	8
Quality planning	2.88	9

Summary of factors determining the implementation of quality culture.

Table 2 reveals that leadership and top management commitment is the highest ranked factor implemented with a mean score of (3.55) while customer management/Focus

(3.5) was ranked second by the respondents with a mean score of (3.30), suppliers' partnership and communication were ranked third. Furthermore, the table indicates that training and education, reward and recognition and quality planning are the least factors implemented with a mean score of 2.92, 2.91 and 2.88 respectively. The result presented reveals that the mean scores were less than 4.0 but greater than 3.0 on a five point likert scale. This signifies that construction industry in Nigeria does not have a full blown culture of quality.

Table 3: factors of quality culture with statistical significance difference (p<0.05)

S/N	Factors of Quality culture	Contracting	Client	Consultant		ANOVA
		Mean	Mean	Mean	F-value	P-value
	Leadership and top management commitment					
1	Quality is not compromised for productivity	4.00	3.06	3.69	6.163	**.003***
	Training and education					
2	International training	2.13	2.93	2.52	3.828	**.026***
3	Training of subcontractors and suppliers	2.18	1.87	2.72	5.094	**.008***
	Team work					
4	Rewards and recognitions to reinforce teamwork	2.89	2.37	3.20	6.538	**.002***
5	Team approach (such as quality circles ,cross functional teams) in problem solving and continuous improvement	2.97	3.00	3.44	3.976	**.022***
	Process management					
6	Documentation of the quality process	3.23	3.25	3.80	3.642	**.031***
7	Use of statistical analysis tools in managing quality process (e.g. measurement of rework cost ,waste ,materials etc)	2.83	2.56	3.42	3.584	**.032***
8	Recognize and reward individual contribution to the process team	2.75	2.46	3.19	3.727	**.028***
	Quality planning					
9	Set up a quality committee/council to provide strategic direction to quality plan	2.62	2.68	3.19	3.956	**.023***
10	Integrating total quality management (TQM) into all planning	2.64	2.68	3.28	5.239	**.007***
11	Development plans for handling non – conformance to quality	2.54	2.93	3.16	4.386	**.015***
	Reward and recognition					
12	Compensation is equitable	2.73	2.50	3.19	3.476	**.035***
	Communication					
13	Communicating success and progress of project between management and employee	3.31	2.80	3.72	4.449	**.015***

***Significant at (p<0.05)**

Test of hypothesis

The study tests the following hypothesis:

$H_0 : \mu_1 = \mu_2$ There is no significant difference in the assessment of quality culture implemented by contracting, consulting and client organisations.

Analysis of variance (ANOVA) at statistically significant ($p<0.05$) was used to determine whether any significant difference exists between contracting, client and consulting firms on the implementation of quality culture. From the results of the ANOVA test, thirteen of the fifty two sub-factors analysed differ significantly in their mean values at $p < 0.05$. This is an indication of significant difference in the level of quality culture implemented between the groups of firms. The null hypothesis of no significant difference between the level of quality culture implemented in contracting, consulting and client organisation was rejected for these factors.

Discussion of findings

Leadership and top management commitment and customer focus have been implemented in the Nigerian construction industry with an approximated mean score of 4.00 on a 5 point likert -scale. In a survey research carried out in Malaysia, top management commitment was ranked first with a mean score of 3.65 (Eng and yusof, 2003). Also, leadership and top management commitment were found to be the highly implemented and practiced strategy in the findings of Dilber, Bayyurt, Zaim and Tarim (2005) and Eng and Yusof (2003). However, these results are apparently lower than the result of a survey in Thailand (Hoang, Igel and Laosirihongthong, 2010) where top management commitment was ranked second with a mean score of 4.02 and customer focus took the lead with a mean score of 4.08. The least factors of quality culture implemented in Nigeria are not different from that cited in the findings of Hoanga, et al., (2010) and Eng et al., (2003).

CONCLUSIONS

The results of this survey shows that there is need for construction industry in Nigeria to focus on improving the practices and implementation of quality culture, especially reward and recognition, training and education and quality planning, in order for quality culture to be wholly embraced and implemented. To assure quality of construction projects, companies should impose a quality plan to be followed by all key players involved in construction projects, subcontractors and testing laboratories. To a limited extent, some factors of quality culture are prevailing in construction works in Nigeria while others are still in their formative and or maturing stage. Leadership and top management commitment and customer focus were seen to be treading on the path of total quality management. However, other factors like training and education, teamwork, suppliers' partnership, quality planning, process management, communication, reward and recognition people management and empowerment are still in their maturing stage in the industry. Training should be considered as primarily a vehicle for implementing and reinforcing quality practices. Moreover, clients should advance from the accustomed practice of awarding tenders to the lowest price and promote rewarding the best team and suppliers who could provide the best service. With proper training and quality awards, the quality awareness can spread widely throughout the construction industry in Nigeria and the achievement of quality culture can be maintained. In addition to the aforesaid, great effort is required from the management to develop the whole company quality culture. The paper recommends that companies should embark on cultural audits before

implementing quality culture so that shared values, objectives and behaviours can be aligned to the goals of the quality plan. Also, an extensive awareness and training programs be initiated to improve the clients' understanding and approach toward quality and hence increase their achievement of quality culture, which would in turn improve coordination, teamwork, productivity, and construction industry performance.

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CURRENT ITALIAN TRENDS AND ANALYSIS FOR INNOVATIONS IN CONTRACTING

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ABSTRACT

The current contracting environment in the construction and services sectors in Italy is heavily impacted by poor economic conditions, making new methods and innovations in procurement and supply chain management attractive. Prior to the implementation of any new restructuring methods or innovations, a proper understanding of the overall state of the Italian economy, including legal implications, current contracting trends, and goals is requisite. Government reports, published statistics, and a recent industry survey are examined and compared. The main challenges in the Italian construction market are identified as: a primarily price-based selection criterion, difficulty for vendors to differentiate themselves, administrative challenges, and decreasing investment. A survey is developed and distributed to Italian construction professionals in order to gain insight into these current industry challenges. Targeted areas and strategies for potential improvement such as financing, procurement, selection, pre-planning, management, and supply chain innovations are suggested. Proposed solutions to the challenges identified are analysed and a future direction for potential Italian construction industry innovations is formed.

Keywords: contracting, Italian trends, management, survey.

INTRODUCTION

As one of the consequences of the financial crisis, the European Union (EU) is experiencing a major downsizing of construction sectors and associated potential output (European Commission 2011). Construction activities within the EU-27 in 2006 generated almost 1,200 Billion Euros, more than 10% of the EU's Gross Domestic Product (FIEC 2007). More than 2.7 million companies, mostly small and medium enterprises, compose the sector and five countries contribute more than three quarters of the total production: Germany, the UK, France, Italy and Spain (Pellicer et al. 2009). With a focus on Italy, the construction and real estate sector is essential to the national economy and accounts for 15% of Italy's GDP. The sector has entered its

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fourth year of decline and is struggling to achieve post-crisis minimums. Beginning in 2008, total investments in construction have decreased by over 20% and are now at approximately the same level as they were in the late 1990s. For public works, the reduction of investments in the same period is 37.2% and, if taken into account the already negative place since 2005, the decline in production loss reaches 44.5%. Overall, 250,000 sector jobs have been lost since the onset of the crisis and company bankruptcies have increased by 102%. The decline is expected to continue in 2012 and 2013 (ANCE 2011 and Bevini 2011).

Italy is seeking solutions and making reforms to ameliorate these economic challenges via a series of governmental actions aimed at reducing the budget deficit and promoting internal growth (ANCE 2011, The Economist 2011). However, Italian construction market research and surveys tend to focus on problems instead of potential solutions (PPN 2011, Inarcassa 2011). Interestingly, the problems of the Italian construction market of the past are quite similar to the present (Pietroforte and Tangerini 1999). Therefore, the objective of this paper is to assist the Italian construction industry and field of research in: identifying innovations to assist with the industry's problems, selecting the appropriate target areas for developing practical solutions, and aid in realizing plans for improvement in the future. Through government reports, published statistics, and surveys, it is discovered that the key areas needing further analysis in order to propose restructuring ideas for the supply chain are in: selection, value-enhancement innovations, administration, and funding.

METHODOLOGY

The Italian construction industry's challenges and current trends are discussed and potential solutions are proposed in response to these problems via an industry survey. The Italian National Welfare and assistance fund for engineers and architects released a survey to its members in order to analyze current challenges and problems (Inarcassa 2011). Based on the trends, a series of questions are further drawn to gain insight into how potential innovations in these areas can be properly implemented. A survey is composed regarding these extracted areas of innovation and solutions. The survey was released to the same group of professionals in the Italian construction and services industry that was originally surveyed regarding the industry's problems in order to gain feedback regarding solutions and matching them with innovations for the overall supply chain improvements. The results of the survey are analysed and recommendations are developed regarding industry solutions.

MARKET ANALYSIS

The European construction market saw deterioration of economic activity in the latter part of 2005, which was manifested also in 2009. The effect of this descent brought about an increase in the need for companies to obtain short-term financing. With an increasing number of banks reluctant to provide liquidity, the access to finance became more problematic for construction companies (Mocanu 2009). Moreover, the EU construction industry has been constantly facing challenges to improve, meet market demand, and overcome skills shortages (Nadim and Goulding 2011).

As far as Italy is concerned, investments in construction projects are declining ((Table 1)). Due to government incentives for renovation works such as tax deductions for green building renovations, the market for residential renovation activities has been the only growing segment of the Italian construction sector in recent times (ANCE 2011; European Commission 2011). Some potential reasons for this decline suggested are: delay in public works payments to contractors by the central and local

governments averaging 6 months and often exceeding that threshold; and red tape as it's estimated that only 45% of the lifespan of an infrastructure project consists of the actual site work, while the rest is consumed by bureaucratic procedures (Bevini 2011). Overall foreign investment in Italy is cited to be declining, leading to less employment opportunities and being hindered by similar factors such as lack of flexibility, high taxes, and bureaucratic procedures (USCS 2011).

Table 1 – Italian Public Investments in Construction (Values in USD Millions) (Bevini 2011)

Segment	2009	2010	2011	2012
Overall Construction	141,707	135,338	132,477	130,806
Residential	76,331	74,011	72,991	74,216
New	32,197	28,769	27,613	26,673
Renovation	44,134	45,242	46,378	47,543
Non residential	65,376	61,327	58,486	56,590
Private	37,633	36,312	35,445	34,781
Public works	27,743	25,015	23,041	21,809
Exchange rate used: EUR to USD	0.718	0.750	0.750	0.750

ITALIAN INDUSTRY PERCEPTIONS

Professionals in the construction and services industry in Italy are witnessing the impacts of these difficult economic conditions and are struggling with the potential resolutions. In December 2011, the Italian National Welfare and assistance fund for engineers and architects released a survey to its 2,000 members in order to analyze current challenges and market trends (Inarcassa 2011). With 353 responses (18% response rate), the survey uncovered some of the main challenges as: a primarily price-based selection criterion, difficulty for vendors to differentiate themselves, administrative challenges, and decreasing investment. Upon further analysis, the challenges survey identified key areas unmet needing further analysis in order to suggest industry solutions in the areas of: selection, value-enhancement innovations, administration, and funding and investment.

Selection

In Italy, a contracting authority has the ability to choose the selection method for their projects in compliance with the legislation (Pacciani and La Rosa 2010). Prior to the onset of the crisis, 50% of infrastructure projects were awarded via discretionary awards and negotiations (Pietroforte and Tangerini 1999). The situation has not changed much, as an analysis of the vendor selection process reveals that the negotiated procedure without publication of notice is the selection method most used in Italian public works projects (Table 2) and has increased overall in usage from 2009 to 2010 (AVCP 2011a).

Table 2 – Italian Public Contracts – Selection Methods vs. Type of Project (AVCP 2011a)

Method	Works	Goods	Services
Negotiation without publication	42.1%	23.2%	23.1%
Open	41.0%	60.3%	50.3%
Negotiation	7.7%	7.2%	10.8%
Restricted	6.1%	7.1%	8.0%
Other procedure	0.4%	0.2%	2.2%
Not identified	2.7%	1.9%	5.6%

Value-Enhancement Innovations

The two selection criteria available for Italian Public Procurements are lowest price and the Most Economically Advantageous Tender (M.E.A.T.). As the M.E.A.T. criterion represents a vendor's opportunity to differentiate themself based upon factors other than price, vendors can provide an indication of their added value via sub-criteria such as: quality, technical merit, aesthetics, environmental, etc. (AVCP 2011b). Prior to the crisis, a lack of consideration regarding past experience and qualifications made price the primary selection criterion in awarding contracts (Pietroforte and Tangerini 1999). The situation has not changed much, with 86.6% of works contracts that used the criterion of the lowest bidder (AVCP 2011a).

By dividing the sectors (Table 3), it can be seen that a majority of the public works projects (10,051 projects) utilize lowest price (AVCP 2011a). While it is commonly held that performance factors should be taken into consideration in the selection criteria, few real project examples have been provided by the literature (Watt et al., 2010). Moreover, M.E.A.T. is used less frequently than its competitor, lowest price, and appears to be difficult to apply in Italy as it is referenced in over thirty individual decrees and laws, is the subject of confusion and fear of legal implications in numerous publications (AVCP 2011b), and is cited to be more time-consuming (AVCP 2011a). The current selection criterion that accounts for performance and overall vendor innovation is not easy to apply and has severe legal consequences, resulting in lowest price being primarily used and vendors not having the opportunity to differentiate themselves and prove their overall value.

Table 3 – Italian Public Works Contracts Awarded vs. Each Criteria (AVCP 2011a)

Selection Criteria	Number of Projects	%	Total Cost	Cost %
Lowest Price	10,051	86.6	7,726,591,293	61
M.E.A.T.	1,527	13.2	4,880,519,841	38.5
n.c.	31	0.3	54,390,430	0.4
Total:	11,609	100	12,661,501,564	100

Funding and Investment

As evidenced by the initial economic market analysis, funding and investment are decreasing in the Italian construction market, causing fewer projects and works awarded. The current funding and investment mechanisms are not adequately providing project opportunities, which seems to result in late payments and decrease in projects under the current framework. According to a survey by ANCE (2011), 48% of construction firms reported that the contract terms for financing already in place had changed throughout the course of their projects. Additionally, the demand for loans by construction companies is increasing due to the following: need to cope with payment delays of public administration (42%), changes in production requirements (30.5%), and inability to self-finance (23%) (ANCE 2011).

Administration

The Italian administration can be seen from its performance as an EU Member State and made up of agencies at the state, regional, and local levels. The Italian administration has a Public Procurement Code that encompasses the European Commission Directives and the Government Procurement Agreement (GPA). The current Italian administration and management are not easy to work under due to reported lack of flexibility, high taxes, and bureaucratic procedures (USCS, 2011 and World Bank 2010). The World Bank (2010) currently ranks Italy 80th (76th last year) on a list of 183 countries for business friendliness, below all other OECD countries,

and 92nd in building permit issuance (bottom 5 of EU countries). The effects of these challenges are in project changes, such as increases in price and schedule. Overall, 68% of projects identified experienced time impacts and 14% experienced cost impacts (AVCP 2011a).

SURVEY FOR SOLUTIONS AND INNOVATIONS

After reviews of the literature, public procurement records, reports, and surveys, it became apparent that the industry could potentially benefit from solutions in:

- Selection - what if there was a system that utilized other factors of selection?
- Value-adding innovations - how can vendors be promoted to add value?
- Administration - how can the burden of administration be lessened?
- Funding and investment - how can funding be increased or stimulated?

A survey was distributed to see if certain innovative solutions to these challenges could benefit the industry as perceived by Italian professionals. In order to receive a more complete portrayal of solutions matching challenges, the solutions survey was distributed to the same Italian National Welfare and assistance fund that took the challenges survey. The survey received 377 responses (19% response rate) and was made available from March 2012 until May 2012. Participants rated the degree to which they agreed that specific solutions could potentially solve specific problems.

Background

Survey respondents were primarily designated as professional architect/engineer/technical services/designer and consultants. Respondents had an average of 237 projects per year. The average overall reported satisfaction with the Italian construction and services industries was 4 (on a scale with "1" being dissatisfied and "10" being highly satisfied).

DISCUSSION OF RESULTS

The suggested innovations were agreed to by a majority of respondents. An analysis was carried out that divided the results based on their scores as "1-3" as disagreed; "4-7" as unsure, and "8-10" as agreed. Overall, participants agreed that the solutions of performance/value-based selection (64%), a holistic business model (54%), aggregation/integration (46%), PFI (62%), PPP (44%), and continuing education (46%) would ameliorate the industry's challenges.

Table 4 – Survey for Solutions and Innovations 2012

No.	Challenges	Solutions	Agree	Unsure	Disagree
1	It has been observed that vendors are primarily selected based upon their price.	Consideration of other selection factors, such as performance, overall capability, and opportunities for vendors to provide innovations could solve this problem.	64%	28%	9%
2	…projects struggle to meet schedule, cost, and achieve client satisfaction and objectives.	A business model and methodology that focuses on vendor risk management, pre-planning, and performance measurements…	54%	37%	10%
3	…organizations are struggling with providing their same level of service and are not financially capable in the current economic conditions.	Strategies such as aggregation and integration (providing more cross-disciplinary services to clients)…	46%	43%	11%
4	…owners do not have the	Strategies such as Private Financing	62%	31%	7%

	financial capacity to initiate new projects in the current economic conditions.	Initiative (PFI)...			
5	…vendors face problems associated with organizational and administrative barriers of owners.	Partnering or Public Private Partnerships (PPP) arrangements…	44%	49%	7%
6	…there is a lack of proactivity and communication between vendors and owners.	General/Project Management training and continuing education to technical employees…	46%	44%	10%

Selection and Value

For the challenges involving selection and value-adding innovations by vendors, a holistic system is proposed in which the entire life-cycle of projects and organizational methodology are addressed in a complete business model. The suggested model of Best Value (BV) applies to organizations via the mechanisms of performance measurement, transparency, accountability, and leadership (Kashiwagi 2011). The term "Best Value for Money" is also widely used in the Italian market and signifies the removal of unfair barriers to competition (Pacciani and La Rosa 2010), which is part of the purpose of the BV Business Model. By focusing on performance, price is no longer the main criterion; instead, clients are given the tools to properly select vendors that provide measurements of their overall value. As an owner-driven program, BV focuses on improving quality through the removal of waste via: reducing client decision making by aligning the most appropriate vendor to the client through performance information; and minimizing the need for redundant client management and direction by successfully transferring risk to the party best fit to address the risk and holding them accountable for the results (Kashiwagi 2011 and Sullivan 2011). Therefore, the problems of the construction industry are addressed via providing performance considerations and complete efficient operations by utilizing the BV Business Model.

Funding and Investment

As a solution to reducing the funding problem, Project Finance Initiative (PFI) is proposed to develop public infrastructure and social facilities in Italy. Under this mechanism a private sponsor finances, designs and builds the project and then operates it for a specified concession period. During this concession period, the sponsor collects revenues from operating the project to recover its investment and earn a profit. Due to the shortage of public funds and increasing demand for construction of public social facilities, privately financed projects have been considered a desirable solution to provide services for the public (Zayed and Chang 2002). Governments increasingly see PF initiatives as a way to relieve the financial burden of the state and attract international investment and technology or to develop domestic technology (Wolfs and Woodroffe 2001). The use of PFI has grown dramatically over the years. Financing almost 4000 projects in 113 countries, the total amount of project finance raised between 1991- 2005 amounts to $1077 bn. While the US, with $186.4 bn accounts for most project finance (followed by Australia and the UK), this form of financing has also been used in emerging economies: such as Taiwan ($64.2 bn), China ($58.9 bn) and Malaysia ($46.5 bn) (Kleimeir and Versteeg 2010).

Administration

For the problems associated with administrative barriers, and bureaucratic procedures of owners, a more extensive usage of owner-contractor shared special purpose vehicle companies and PPP forms of arrangements are suggested. For enhancing pro-activity and communication between vendors and owners, it is recommended that staff be trained with Project Management continuing education in order to let technical employees integrate both soft and hard management skills into their background technical expertise. This is expected to enhance planning, monitoring and communications skills for better proactive project delivery.

CONCLUSION

Based on the survey responses regarding potential solutions and supply chain innovations, it is recommended that the Italian industry should investigate all of the identified innovative strategies. Special attention and analysis should be given surrounding the highest rated strategy of performance/value-based selection of vendors. Overall, participants agreed that the solutions would ameliorate the industry's challenges. Returning back to the original questions, new industry and research directions can be drawn:

- Selection - explore systems that utilize factors of selection besides price.
- Value-adding innovations – find ways to educate or encourage vendors to be promoted to add value to their projects in pre-planning.
- Administration – work towards lessening the burden of administration.
- Funding and investment – encourage increase and simulation funding via proper planning.

The Italian construction industry is facing difficult times and future downturn could be ameliorated with these solutions and innovations. It is recommended that feasibility studies be carried out with respect to these methods to determine their potential impacts. Additionally, surveys from differing perspectives (i.e. vendors, owners, etc.) and different countries (other European countries, the Americas, Asia, and a comparison with other countries) would provide benefit to future research.

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DRIVERS AND OBSTACLES FOR EMPLOYEE-DRIVEN INNOVATION IN LARGE CLIENT PROJECT ORGANISATIONS

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ABSTRACT

In recent years implementation of various types of development and innovation approaches has been adapted in the construction industry, without any of them fully matching the expected success. Through a focus on, how to generate most value in the daily work and problem-solving processes, and in sequence increased revenue, this study suggests that the key source for innovation is the employees. Employee-driven innovation (EDI) is a methodology to take advantage of employees' spoken and tacit knowledge in the development of new tools and structures. To utilise this approach in optimising the construction project management processes is a relatively new approach to engage innovation. In this broad perspective the aim is to map the boundary conditions for an EDI approach in a client project organisation and compare these with the theoretical methodology for conduction EDI. Trough semi-structured interviews this study will discover the conditions such as drivers and obstacles for EDI within major client project organisations. The field around EDI will be studied to discover the most potential management philosophies and methods. Based on this study, the theoretical approach to engage EDI in client project organisations is compared to the boundary conditions of the organisation.

Keywords: construction innovation, change management, employee-driven innovation, knowledge sharing, project organisations.

INTRODUCTION

The construction industry is, in many countries, considered to be a slow adopter of new technology and new processes. In general, it is not regarded as an innovative industry (Wandahl et al. 2011a). Instead focus is on short-term gains, instead of long term planning of development and innovation. When the industry booms, the industry gear up, man and machinery wise, and engage in as many projects as possible, disregarded the cost, more or less (Wandahl et al. 2011b). There is a lack of competition, and construction companies feel no need to use resources on innovation. In times of recession competition is substantial, and the companies gear down, and cut

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off all possible costs including R&D. Thus, the focus on long-term development and innovation has rough conditions to subsist in the industry.

In large project organisations that are based on new bonds and relations in drifting systems (Christensen and Kreiner 1991), the employees are an important and effective source of innovation that are often ignored or unseen in innovative approaches. In terms of their experience-based and up-to date knowledge about the projects, employees possess the newest and most valuable knowledge about materials, markets, customers, processes and customers/users. Hence, it is an obvious source of information and knowledge within the organisation, who can share their practical experiences and know-how in informal networks or forums (Høyrup 2010).

State-of-the-art

Involvement of employees has been a research topic for some years, but it has never been formalised in terms of a theoretical or practical framework (Bakker and Demerouti 2008) Hence, a methodology to take advantage of employees' spoken and tacit knowledge in the development of new tools, structures, and processes to optimise the construction project processes, is an emerging approach to engage innovation.

There are many traditional ways to use the employee's experiences in evaluation of the working processes in the organisation, e.g. team meetings, walk and talk session, evaluation schemes. A more recent theory, in using employees in the development of organisations, is Employee-driven innovation (EDI). This approach adapts a systematic involvement of employees in the innovation process, centred on idea-generation from employees, and a framework that can transform these ideas into new tools or working processes.

In general the EDI approach is a bottom-up process that focuses on innovation driven by the employees' ideas, creativity, competences and problem-solving abilities. The process needs to be supported and organised by management. Furthermore, it concerns all types of innovation activities; process, product, organisation, market, and so forth, both incremental and radical (Høyrup 2010). EDI is not a well-documented field of research in the general innovation literature. EDI is often seen in a greater innovation context, in which it often is de-emphasised contrary to product and process innovation (Høyrup 2010). Dobni (2006) presents "The innovation blueprint", a general innovation model where the employee's figures in the organisational mindset that should drive the organisation towards innovation. Hence, a company that succeeds in innovation cannot only be defined in the company's external behaviour and actions, it is to a great extend also determined by the culture and the mindset of employees in all levels of the organisation. In The Innovation Blueprint model the employees' competences and development is an important factor in an organisation's desire to invest in innovation and development. This model differs from the basic perception of EDI in the way that the employees are not considered a source for innovation, but merely as a support function that is aligned with the R&D or market innovation. Hamel (2006) also focuses on this paradox. He emphasises that more competitive advantages are developed from the non-technological innovation compared to the innovation developed from technologies and laboratories. Hamel denotes examples on how to link management and innovation in large project organisations by focusing on employees and management, and on how to create innovation through organising, leading, coordinating and motivating the employees. In project based organisations within the construction industry, knowledge and experience in terms of products and processes are often closely related to individual

employees and often irregularly driven by these employees. This knowledge is often very difficult to identify, collect, share, and utilise. Therefore the approach requires a systematic structure or methodology such as EDI, which features tools for managing structure, culture, and methods in project organisations (Teglborg-Lefévre 2010; Høyrup 2010).

Development of methodologies to coach or train employees in identifying problems in the working processes, generate ideas, and transform them into solutions, is also considered to hold a higher level of novelty. Furthermore, it is essential that this development is seen in an interdisciplinary perspective, thus it can be deeply rooted in all units and at all levels in the organisation, and in the end be beneficial and value adding.

Objectives
This research takes its departure in the following objectives

- Deriving a map of the boundary conditions and point of reference for conducting EDI in a client project organisation
- Discussion of possible drivers and obstacles for conducting EDI in large client project organisations.

METHODOLOGY

This study takes its departure in a desire to challenge the capabilities for innovation and willingness to change in the construction industry, based on the challenges in a client project organisation. The focus on the employees is based on, how to capture and utilize their tacit and spoken experience and knowledge in the development and innovation of the organisation and its products and services.

Semi-structured Interviews
To map the boundary conditions and identify the point of reference for approaching EDI in a large client project organisation, various employees have been interviewed.

The interview approach was conducted through a semi-structured interview to ensure an open and focused two-way communication with the employee. Using this method should ensure a confirmation of what is already known, and the possibility to investigate new point of views. Selection of respondents is based on these criteria: they should be affiliated with a geographically spread office location; they should occupy different job-functions; they should have various experience and length of employment; and they should be of various ages. Table 1 illustrates the selection of respondents in relation to these criteria.

Respondent	Job function	Experience	Location	Age (app.)
1	Architect - PM	8 years	East office 1	50 years
2	Engineer - CM	3 years	Vest office	38 years
3	Chartered Surveyor - CMM	2 years	North office	30 years
4	Engineer - CMM	4 years	South office	32 years
5	Engineer - CM	25 years	East office 2	60 years

Table 1 – Selection criteria for semi-structured interviews. PM = Project Manager, CM = Construction Manager, CMM = Construction Maintenance Manager

To ensure that the interviewee was open-minded and spoke without stinting, they all figure anonymously in the documentation. All questions were formulated as openly and objectively as possible, to both ensure that the interviewee did not sense any bias from the questions, and to compel them to reflect why they answer in the given way. All interviews were audio recorded to enhance documentation and following analysis.

The collected qualitative data was processed in two ways. Some of the answers were, as far as possible, quantified to see how many of the interviewees that answer in the same way. Furthermore, the semi-structured interviews are transcribed in full length and the answers are analysed for recurrences, keywords or statements that could indicate an attitude or feeling to a specific subject that are not clearly spoken in the answer.

Employee-Driven Innovation

The empirical data must be compared to the theoretical approach to discover the drivers and obstacles for conduction EDI in the case organisation. The theoretical approach to EDI embraces elements of a variety of management philosophies, such as *entrepreneurship*, *lean construction*, *managing innovation*, *workplace learning*, *change management*, *the learning organisation* and *value-based management*, inspired from Ramboll (2006) and (Høyrup 2010). These philosophies should explore a framework for EDI that in one end captures or contains ideas from employees and in the other end ensures that the ideas are developed into new tools to optimise the processes and problem-solving.

Hence the review of these management philosophies shall explore the most beneficial and high impact segments of these methodologies in developing a framework for an EDI approach to innovation in a large client project organisation.

THE CASE ORGANISATION

In this research, the case organisation is the governmental client organisation Danish Defence Estates & Infrastructure Organisation (DDEIO), who is an integrated part of the Danish Defence. DDEIO's main focus is to develop, operate, and deliver the physical conditions that are necessary for the operational forces, but also to the other authorities within the Danish Defence organisation.

The Construction Division (CD) within DDEIO is organised in three departments; the Project Department that primarily conduct new build, the Maintenance Department that conduct all maintenance of Defence properties, and the R&D department that support all R&D, legal, technical, and administration issues. The organisation around CD is still affected on older military traditions, which are realised in a bureaucratic and hieratical organisation, in which you communicate along the chain of command. This also results in a culture, wherein many officers and managers are involved in projects and thus want their influence forced through. Most of the employees are relatively highly educated in terms of architects, engineers, Chartered Surveyors, lawyers, controllers, and so forth. Hence, the potential to involve employees in development and innovation tasks is evident in this organisation.

RESULTS

The most relevant questions from the semi-structured interviews and the respective answers for mapping the boundary conditions for EDI are shown in Table 2.

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	1	2	3	4	5
Q1	Do you feel that the employees are motivated to get involved in development, if they feel that they have ideas to optimise the working-processes?				
Yes/no	No	No	Partly	Partly	No
Keyword	Generational change	Innovation from new employees	Mostly know-ledge sharing between employees	Younger and new employees are more active	Time is prioritised for production
Q2	Does your department have systematic activities to ensure that experiences and new ideas are captured and utilized in the development work?				
Yes/no	No	No	No	No	No
Keyword	Based on individuals	It is running autonomous, autodidact	Only informal and related to individuals	Experienced employees feel it is a waste of time	Only briefly, if any, on weekly department meeting
Q3	Are the employees broadly and systematically involved in the development, or is the participation in development activities randomly?				
Yes/no	No	No	No	No	No
Keyword	Spontaneous or randomly	Emanates randomly from the same employees	Only through random meetings in experience sharing groups	Based on passionate individuals, primarily younger	Time and resources are prioritised to production processes
Q4	What do you see as the most significant obstacle for the development to be driven by the employees on the floor?				
Keyword	Culture for curiosity and wondering	The R&D-function, it is invisible	Culture, framework for working processes	Time, resources, no prioritising of development	Time, support from upper management, organisation

Table 2 – Output from semi-structured interviews.

Q1: 3/5 of the respondent's answers indicate that in general the employees are not motivated for involvement in the development processes. 40% indicates that there could be some motivation in participating in development. 60% also indicates that the motivation to engage in development is mainly visible amongst the younger employees and that the development merely is based on informal knowledge-sharing between employees.

Q2: 5/5 of the respondents answer that their department has activities that systematic neither gathers experiences and ideas nor utilises them in the development of the organisational processes. According to a keyword analysis, the knowledge-sharing and idea generation are based on individual employees and the process is informally and irregularly driven. The effort is mostly seen with employees with less experience, since they are more open minded and have less faith in the bureaucratically paradigms defining the problem-solving processes. Whereas the more experienced employees have been in the system for a longer period and have adjusted to the organisational culture and processes, thus they do not have the same need for change.

Q3: 5/5 of the respondents answer that there is no broad and systematic involvement of employees. The keyword related to the answers suggests that the process is randomly and based on the same individuals, who are passionate in seeing new solutions and innovative approaches to the problem-solving processes. Hence the potential is related to a more systematic approach in involving the employees.

Q4: Two of the most significant obstacles for the development to be driven by the employees are the time and resource issue and the management support in prioritising the development approach in daily working processes.

DISCUSSION

In the following writing the key issues from the theoretical approach to EDI are presented, contemporary with a discussion of the results from the semi-structured interviews against the current perception of EDI. This should discover some of the drivers and obstacles for conduction EDI in a larger client project organisation.

A fundamental dilemma in EDI is the fact that the decision authority lies with a small number of specific functions and managers. The vast majority of the employees in the organisation are not involved (Kesting and Ulhøi 2010). Hence the thoughts behind *The learning organisation* on daily and continuous learning in all levels of the organisation are the essential parts in preparation for securing the innovation capabilities of an organisation (Wang and Ahmed 2003), could be sensible to integrate in a framework. An obstacle in the CD organisation in DDEIO could be derived from Q2, where the involvement in development and innovation is not present. And from Q4, where management support and prioritising of development are absent. Hence the lack of management support and organisational culture to secure innovative capabilities are absent. Another dilemma in adopting an EDI approach is managing the employee's incentives between on one hand the curiosity in exploration and in the other exploitation in the daily production processes (Hellmann 2007). From Q3 it comes clear that the focus in CD is on the production related tasks and the incentives to and curiosity in idea generation are more or less non-existing. This could be approached by integrating some of the elements in the philosophies *Change Management* and *Managing Innovation*, where it's important to have a structural approach to the innovation. Hence a systemized procedure, that organises how the innovation opportunities are discovered, to select the right ideas, develop and implement the idea and capture the benefits (Tidd and Bessant 2009).

The existing theory within the field of EDI focuses on the basic premise that the employees' possess hidden abilities for innovation, and further how these abilities can be integrated in the development routines of the organisation. Research on EDI has to take the underlying management and decisions-making processes into consideration (Kesting and Ulhøi 2010). Hence development of a structure or systematic approach to capture and store the experiences and ideas from the employees is of the essence, when it comes to further idea generation, development and implementation of the input. The answers from Q2 strongly indicates, that this could be a strong obstacle, when 5/5 of the respondents from various geographically located departments cannot recognise these activities in their working processes.

One of the key notes in Kesting and Ulhøi (2010) stresses that the employees, delivering innovation inputs, should participate in decision-making procedures from which the innovation is triggered and determined. This directs attention to both *Lean* thinking (Howell and Ballard 1998), and to the *Entrepreneurship* philosophy (Praag and Versloot 2007). In which the employees are respectively focusing on reducing waste and making radical innovation. Thus it will be obvious to integrate the most relevant from those philosophies.

Contrary to R&D based development, EDI focuses on a bottom up development and innovation approach from all employees in the organisation. This bottom up approach relies on the managers to plan for and facilitate the employees' involvement in these decision-making procedures. And simultaneously, the process will be valuable for the organisation. This perspective could be an inspiration from both *Value-Based Management* (Tissen et al. 1998) and *Workplace Learning* (Billet 2001), also focusing on, how the employees engage these learning and development procedures, which Q1 suggest could be obstacle for the EDI approach. One of the drivers could be the younger employees desire to optimise the organisational routines and processes.

The upper management's information is often limited to strategic levels, thus the awareness and the knowledge of the operational routines in the problem-solving processes are often inadequate in terms of the development and innovation potential (Kesting and Ulhøi 2010). Q4 suggests that this is a key obstacle in both organisational culture and management support and prioritising of the development processes. This can entail inadequate communication up- and downwards including the fact that information about employee ideas and needs will only to a less extent reach the R&D-function, whereas the potential for a successful innovation process is reduced.

CONCLUSION

The drivers and obstacles for conduction EDI in a client project organisation are through this research discovered as:

Obstacles: No incentives or motivation to engage development and innovative activities; Management focus is on production tasks, hence no management support; No systematic approach to facilitate idea generation or knowledge-sharing; Organisational culture, development and innovation are based on individuals.

Drivers: The curiosity emanating especially from the new employees; Motivation could emerge from management support in prioritising time to development and idea generation.

Some of the obstacles discovered through the interviews are convergent with those emphasised by (Kesting and Ulhøi 2010), indicating that they are of a more general character and could be point of departure for a broader framework for conduction EDI.

This research is a part of a PhD study, thus conduction of an extensive literature review is one of the obvious research areas in the near future. Furthermore, this will form the base for developing a framework of tool and methods for engaging EDI in client project organisations. It could also be advisable to analyse the relations between the obstacles, as they could originate from the same sources. Another future research area is making the framework transferrable to other types of organisations within the construction industry.

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IDENTIFYING COMMON DEFECTS IN NEW RESIDENTIAL BUILDINGS: A NEW ZEALAND STUDY

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ABSTRACT

Improved quality performance within the residential sector has been an issue of concern for both government and building approval authorities in New Zealand. As a result, the quality of new residential buildings has come under scrutiny, particularly the nature of the defects occurring in new homes at handover. Therefore the objective of this study is to compile common defects identified by new homeowners in new residential buildings in New Zealand with a view to improving quality achievement levels. A questionnaire survey approach was employed to administer mail questionnaires to new homeowners in five major regions in New Zealand. A list of common defects was included in the questionnaire with research participants required to indicate the defects that they observed at the time they took possession of their properties. The analysis of data from 216 respondents is presented as part of a larger study being undertaken in New Zealand that seeks means of improving quality achievement levels in new residential buildings in the housing sector. It is hoped that the result of this research will help the residential construction industry to establish more aggressive and proactive measures of monitoring its final product to the satisfaction of new homeowners.

Keywords: defects, homeowners, New Zealand, quality, Residential buildings,

INTRODUCTION

The residential building sector forms an essential part of the New Zealand economy. The sector alone has a total market value of between NZ$450 and NZ$500 billion making it the largest asset class in New Zealand (DTZ New Zealand, 2004)). More recently (in March 2012) there is indication that the value of residential buildings has picked up since the recession, with the value of residential building consents rising by 30% compared with March 2011. This current spike is the highest value of residential building consents recorded since September 2008 (Bascand, 2012). This increase in the number of residential buildings will mean that more proactive measures are required to monitor the quality of the final product in a way that it meets project owners' needs. Recognising also that home ownership means so much to New Zealanders and settlers, good quality homes will mean high satisfaction levels with

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the performance of home builders. New Zealand has a high rate of home ownership (67% or 1.5 Million owner occupied dwellings in 2006 (Fortes and McCarthy, 2010).

The fact that most of the country's wealth is tied up in buildings means that any unnecessary quality non-achievement will impact the general economy. Therefore an understanding of the nature of defects will create awareness that could help to enhance building performance levels. More so the Building Research Levy in New Zealand identifies the residential building sector as one of the key areas requiring performance improvement.

Sufficient evidence suggests that there are significant number of defects in new residential buildings (Craig, 2008, Love and Sohal, 2003, Mills et al., 2009, Page, 2011, Rhodes and Smallwood, 2002, Sommerville, 2007). For example Craig (2008) estimates an overall industry average of 53 defects per new homes in the UK from a period of 2002-2006. Mills et al. (2009) on the other hand reveal that one out of eight buildings have defects and the estimated cost to rectify these defects is 4% of construction contract values. Craig's study was a first step towards providing a benchmark figure for the house building sector in the UK (Craig, 2008). This serves as an example for other countries to emulate.

In New Zealand, Page (2011) identified some defects during a pilot study of new house owners. Page's study was aimed at monitoring call backs, as an indicator of construction quality. The result of the study found that a significant number of new homes (60%) require defects rectification, suggesting that improvements were needed to work performance by home builders. The current study extends Page's pilot work with a view to providing more detailed data on the nature of these defects.

Therefore the current study extends previous study findings on defects in New Zealand. It presents the results of an investigation into the nature of defects common to new residential building in New Zealand, at the point when new homeowners take possession of their properties. The authors believe that through an understanding of the common defects in new residential buildings, home builders can better focus their attention to these salient problem areas. This should also benefit whole-of-industry by helping to keep pace with the ever-continuing rise in quality expectations.

BRIEF LITERATURE REVIEW

Defects in Residential Buildings

According to (Georgiou et al., 1999) a defect is a situation where one or more elements of a building do not perform its intended function. Similarly defect refers to failure or shortcoming in the function, performance, statutory or user requirements of a building that manifest itself within the structure, fabric services and other facilities of the building (Ilozor et al., 2004). So long as the expected final product fails to meet the required quality, then a building is said to be defective (Kim et al., 2007). Georgiou, (2000) identifies three different forms which defects in residential buildings could take: technical, functional and aesthetics. Technical defects are contraventions to building regulations and this aspect relates to workmanships, materials or designs that fall short of statutory requirements. The functional aspect relates to omitted parts or features that do not meet functional requirements, while the aesthetic aspects relate to the physical appearance and features of completed buildings. Alternatively Kim et al. (2007) identifies two categories of defects from a functional perspective: a final product that does not function appropriately, and a final product that functions but does not provide satisfiable results. Kim et al's (2007) two categories were perspectives not only from building inspectors or project managers

but also from homeowners. A more detailed categorisation of defects that could occur in a house building project is given by Sommerville and McCosh (2006). The categorisation includes seven complex combinations of: aesthetics, aesthetics and technical, technical, technical and omission, omission, omission and aesthetics, and aesthetics, technical and omission respectively. These distinctions are important because they provide an understanding of customers' needs and focus that are required to be met by home builders. It is made clear from these seven aspects and combinations that defects occur either during the building process or after buildings have been completed. Identifying and rectifying these defects would allow home builders to track improvements that could provide better quality products and services to the end user.

Homeowners represent both the 'paying' customer and the 'buying' customer (Torbica and Stroh, 1999). Therefore their needs and expectations are vital as these define the quality attributes of any building project (Dikmen et al., 2005). However, Craig (2008) explains that new homeowners are more likely to have a strong emotional attachment with the quality of the product itself and the softer issues of quality such as aesthetics. Auchterlounie (2009) study also confirm that aesthetics and the finishing aspects of buildings are of greater importance to homeowners, because homeowners view the technical aspects has a 'given' as they are covered under the various regulations and building standards. Craig (2008) study on 3696 new homes in the UK found a total of 199,095 defects of which about 90% of the defects were classified as aesthetic defects. While these are not likely to create health or safety problems, they are annoying to owners and suggest a lack of concern for quality achievement in new buildings (Page, 2011). These findings seem to suggest that aesthetics and the finishing aspects of buildings are of greater importance to homeowners. It is common for new house buyers to carry out visual inspection before the purchase of their new homes, although this visual inspection may not identify all defective works due to homeowners' lack of knowledge.

Record keeping of minor or major defects have become imperative components of the house building sector in New Zealand (Beattie, 2011). However the sector still lacks large database of historical defects that could help monitor the nature of defects in its final product. Though monitoring is often suggested, it is rarely carried out, especially with new builds (Rotimi et al., 2011). A comprehensive and effective monitoring system could enable defects to be traced and categorised so that their root cause(s) could be determined. When carried out, homeowners could have better recourse to address the issue of defects, particularly with respect to how the defects can be managed, who should be responsible and what not to be accepted (Isa et al., 2011). One major benefit of identifying common defects in new residential buildings, as an upstream quality improvement practice, is the positive effect it can have on new homeowner satisfaction. It is therefore reasonable that experts (building inspector) are engaged to undertake in depth investigation on building quality. This benefits the home buyer as they become rest assured of the quality of their purchase and equally benefits the home builder since historical record of quality achievement or non-achievement will improve their future performance.

METHODOLOGY

The aim of the research is to investigate the nature and extent of defects occurring at hand over of new residential buildings to homeowners in New Zealand. It is an aspect of an on-going study, which has one of its objectives as identifying common defects in new residential buildings. The study uses more detailed data than available in

previous studies. In order to satisfy the aim of the research a mixed method approach was adopted involving questionnaire survey to new homeowners and interviews with well-established home builders. The result of the interviews is not presented in this paper. Johnson et al. (2007) describe mixed method research as a situation where a single investigator collects and analyses data, integrates the findings and draws inferences using a combination of qualitative and quantitative approaches.

The data used for this study was collected from new residential homeowners within five regions in New Zealand. New homeowners were selected by random sampling in order to provide an unbiased subset of the population (Collis and Hussey, 2009). Out of 1290 questionnaires administered to new residential homeowners, 228 were returned of which 96% were usable and the remaining 4% unusable. The total number of usable questionnaires after data clean-up was 216, representing an overall response rate of 16.7%. Though the percentage of response appears small, the total number of response as a whole is statistically significant. A total number of 127 questionnaires were returned because the delivery points could not be located by the postal agency.

A simple interpretive and descriptive method of presentation is adopted for the study findings so that these could be communicative and understandable to readers. McQueen and Knussen (2002) explain that descriptive statistics are used to describe, illustrate and summarise information using three ways: forming numbers into tables, generating charts and diagrams from the numbers, and then calculating general statistics.

RESULT AND DISCUSSION

The opening section of the questionnaire was designed to capture demographic information of the research participants. Some of the questions asked covered: type and period of ownership of their homes, house type, number of bedrooms and information on who built their homes. The objective of these questions in this section is to determine the nature and demography of the respondents and to be able to use the information to explain responses to other parts of the questionnaire.

The majority of the research participants indicated that they own their homes (98.6%) with only (1.4%) under a rental agreement. This is in line with the focus of the research which aims to target new residential homeowners only.

In response to the question on how long homeowners have owned their homes, the result shows that the largest percentage (58.6%) of the participants has owned their homes for between six months and two years, followed by the participant who indicated that they have owned their homes for over two years (27%). The desire of the study was to target recent homeowners so that their opinions on defects they observed after they purchased their new homes could be determined, as opposed to maintenance related defects.

The third question required participants to indicate the types of houses they own. This is to enable the research to understand the different categories of houses surveyed. The results shows that majority of the participants (94%) fell into the house category which means the buildings are single family dwellings. 5% of the participants owned a town house, while only 0.5% of participants owned a unit and retirement village respectively. None of the respondent owns apartment buildings.

The fourth question required participants to indicate the number of bedrooms in their homes. The purpose of this question is to match the number of defects indicated by the participants to number of bedrooms. The result shows that majority (53%) of the participants occupy four bedroom houses, while 33.5% three bedrooms, 7.4% had five

or more bedrooms and 5.6% of the participants with two bedrooms. One bedroom occupants account for the lowest responses (0.5%). Participants were further asked to indicate the number of occupants in their homes. The result shows that 41.9% of participants had two occupants. Another 24.7% had four people living in their homes. 13% of participants had three and five or more people occupying their homes, while few participants (7.4%) indicated that they were the only occupants in their homes. Comparing these two questions, one could conclude that the buildings were moderately occupied (moderate density). Considering that the highest percentage of the new buildings had more than four bedrooms yet the highest percentage of building occupants was two.

The last question in the section covers the type of builders that built the homes. 62.8% of the participant's indicated that their houses were built by registered Master builders and 14.4% by certified builders. 8% of the respondents were owner-built, while 11% of respondent had their houses built by private developers. Only 4% of the respondent indicated that they do not know who and how their houses were built.

Defects Observed by Respondents

This section of the questionnaire required the research participants to indicate the types of defects that they observed when they took possession of their new homes. The objective of this question is to allow participants to identify from their own perspective which items were defective in their homes when they took possession. 43 common defects in residential homes were provided by the researcher in line with standard terms extracted from previous literature. The participants could also add more to the list if they had observed defects different from the ones provided in the questionnaire. A total of 81% of participants responded to this question. Meaning a significant percentage (81%) of participants had identified a defective item when they purchased their home. The remaining 19% could be said to be defect-free at the time they took possession of their homes.

On the whole the research participants confirmed observing 42 of the defects provided and also identified 13 additional defects. The 10 most occurring defects in the order of their frequencies are: uneven painting, nail pops, poor finish, flooring, door/window handles, kitchen units, cracks, toilet/WC, locks, and concreting. What may not be obvious from this result is the number of defects experienced by individual homeowners. For example a worst case situation was a total of 43 defects experienced by one of the homeowners. The homeowner attached the list of the defects with the questionnaire to support their opinion that their home builder under-performed. This particular homeowner had indicated that another builder was called in to rectify the defects, after three court cases with the original builder.

The nature of defects identified by the participants are in line with Auchterlounie's (2009) study that found that aesthetics and the finishing aspects of buildings are of greater importance to homeowners, because homeowners view the technical aspects as a 'given' as they are covered under the various regulations and building standards

Distribution of Defects by House Size

Table 1 shows the distribution of defects identified by the participants across 216 buildings. The purpose of this section is to determine the total number of defects in each property type. The defects were grouped into 4 categories: 0 - 5, 6 - 10, 11 - 15, and 16 - 20. A total number of 752 defects were identified across all 216 buildings surveyed from 2008 to 2011. The result show that four bedroom houses had the highest number of defects of between 0 - 5 defects, followed by three bedroom

houses. Four bedroom houses also recorded the highest in defects between 6 - 10 defects. From the analysis of the data by house size, it is clear that as the number of bedrooms in homes increase, so did the number of defects.

Table 1: Distribution of defects across 216 buildings

No. of Defects	Total no. of houses	1 Bdrm	2 Bdrm	3Bdrm	4 Bdrm	5 Bdrm & over
0 - 5	165	1	10	59	85	11
6 - 10	41	0	2	9	25	4
11 - 15	6	0	0	1	4	1
16 - 20	3	0	0	3	0	0
Totals	215	1	12	72	114	16

Extent of Defects

The research participants were asked to indicate on a five point Likert scale (with 1 being Very High and 5 being Very Low) the extent of defects they observed when they took possession of their new homes. The purpose of this question was to provide an alternative approach to defects observed by new homeowners. 82.8% of the participants responded to this question.

The result shows that all the 82.8% of the participants that responded to this question had identified some defects or quality failures which needed to be rectified at some point during occupation of their buildings. However, a significant number (54%) of the participants indicated that the defect they noticed when they took possession of their homes was very low. 14.4% indicated average defects, 7.9% low, 4.7% high and 1.9% very high defects respectively.

Though a significant number of the participants indicated very low defects, it is possible that the results may be different if suitably trained building inspectors had undertaken the inspection of the buildings after possession. Most of the participants experienced minor construction defects, but not all of these defects were dealt with efficiently. Many of the participants commented negatively about the quality of workmanship of their new homes which they had not identified during possession, but were finding it annoying as they lived in it.

CONCLUSION

The study has shown that the occurrence of defects at handover is evident in new residential buildings. The study collected information from homeowners and they have indicated very low defects. But in spite of this low number of defects, they were considered annoying and homeowners would prefer defect-free homes. 10 common defects were identified in the study. These include: uneven painting surfaces, nail pops, poor finishes, poor flooring, poorly fixed door and window handles, poorly installed kitchen units, building cracks, poorly fixed toilet/WC, locks and concreting. Overall a total of 55 common defects were identified from the 216 residential buildings studied.

Residential building construction requires creative and sustainable solutions that could transform current poor quality performance. One important measure that could help in accomplishing this goal is to establish an efficient and effective monitoring of defects during building production processes. Home builders need to keep records of their call backs in a manner that could permit positive contribution to the improvement of current and future performance. This will make it possible to establish a set of quality criteria that could be delivered consistently to homeowners.

These criteria would have as a basis an understanding of homeowner needs and expectations. The common defects identified relate largely to aesthetics and the finishing aspects of buildings.

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MEASUREMENT CONSTRUCTS TO EXPLORE INNOVATION DIFFUSION IN CONSTRUCTION

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ABSTRACT

Although the drivers of innovation have been studied extensively in construction, greater attention is required on how innovation diffusion can be effectively assessed within this complex and interdependent project-based industry. The authors draw on a highly cited innovation diffusion model by Rogers (2006) and develop a tailored conceptual framework to guide future empirical work aimed at assessing innovation diffusion in construction. The conceptual framework developed and discussed in this paper supports a five-stage process model of innovation diffusion namely: 1) knowledge and idea generation, 2) persuasion and evaluation; 3) decision to adopt, 4) integration and implementation, and 5) confirmation. As its theoretical contribution, this paper proposes three critical measurements constructs which can be used to assess the effectiveness of the diffusion process. These measurement constructs comprise: 1) nature and introduction of an innovative idea, 2) organizational capacity to acquire, assimilate, transform and exploit an innovation, and 3) rates of innovation facilitation and adoption. The constructs are interpreted in the project-based context of the construction industry, extending the contribution of general management theorists. Research planned by the authors will test the validity and reliability of the constructs developed in this paper.

Keywords: construction projects, diffusion process, innovation.

INTRODUCTION

The study of construction innovation remains an important topic for researchers as innovation is recognized as an essential survival trait for construction organizations (Gambatese and Hallowell 2011). With input from research on how innovation can be maximized, construction organizations are placing greater strategic emphasis on purposefully managing innovation (Gann 2000). Despite increasing emphasis on how innovation can be maximized within and across construction organizations, challenges remain over the complexity of innovation diffusion in construction. This involves understanding how contextual variables influence the accumulation of innovation knowledge across project teams to evaluate the potential benefits of an innovative idea put forward. Indeed, guidance is scarce on the process of how construction organizations assess the potential of an innovation (Hartmann 2006a). These challenges partly stem from the unique nature of the construction innovation system, where there are high levels of interdependency concerning the innovation diffusion, requiring intensive interaction and collaboration between a wide range of functions for success (Bessant 2006; van der Panne et al. 2003).

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Thus, a construction organizations' ability to encourage the uptake of an innovative idea depends heavily on the nature of their external environment, in light of their internal capabilities. For example, the cultural attitudes of interrelated project organizations can have a significant impact if a proposed innovative idea is implemented in a construction project (Hartmann 2006b). Similarly, the temporary nature of construction teams makes it difficult to build the strong relationships often needed for the diffusion of innovative ideas. There is a large body of construction management literature advocating the need for improved supply chain integration for the benefit of project outcomes, including innovation supply-chain integration (London 2001; Gann and Salter 2000; Hinze 1994). Not only does the nature of the project production method lead to discontinuities across project relationships, it also introduces risk adversity when considering new ideas due to the limited previous dealings between project stakeholders. Established long-term relationships can have a major impact on the willingness to adopt an innovation (Bossink 2004). Despite this, there remain diffusion difficulties relating to a lack of ongoing accumulation of innovation knowledge across project organizations and from project to project, that can lead to unwillingness to consider innovative ideas for adoption.

For these reasons, in terms of theory, it is not advisable to use generalized innovation diffusion concepts for use in the project-based construction industry. As innovation is context specific, research and policy needs to be fit-for-purpose to suit the unique nature of project based firms (Blindenbach-Driessen and van den Ende 2006). Clear differences between project-based industries, such as construction and say, the manufacturing industry requires innovation models to be carefully contextualized and applied to suit different perspectives (Blindenbach-Driessen and Van den Ende 2010; Widén 2006). This paper responds to this need by developing a conceptual framework that proposes three critical measurements constructs to be used to inform the nature of the diffusion process in the context of a construction project.

Firstly, the research is contextualized, to define the process model for innovation diffusion and highlighting the stakeholder characteristics required for effective transfer of innovation knowledge on a construction project. This work draws from management literature on innovation diffusion with particular emphasis on the diffusion model originally developed by Everett Rogers in 1962. Although there has been many variations to Roger's diffusion process model (e.g. Wolfe 1994; Cooper and Zmud 1990) with greater or lesser graduations between stages, Roger's model is the most influential and frequently cited (Nutley et al. 2002). According to Larsen (2005), Rogers' innovation diffusion theory provides 'the most comprehensive and cogent presentation of the theory' (p.788). To date, according to Google scholar search engine, Rogers book "Diffusion of Innovations" has been cited over 39,000 times and is the seventh most widely read book concerning innovation in the world (Folkestad and Gonzalez 2010).

Secondly, measurement constructs to assess the effectiveness of the innovation diffusion process are proposed. The framework is presented in light of the prior conditions required for effective innovation idea generation and diffusion. The framework enables exploration of the characteristics of key construction industry stakeholder in the diffusion process. It is intended that this framework will be employed to improve understanding innovation diffusion on construction projects. The following section provides background information on innovation diffusion and

the associated process model, followed by a discussion of our conceptual framework incorporating our three-fold measurement constructs across the diffusion process.

INNOVATION DIFFUSION

The seminal author of innovation diffusion research, Everett Rogers, defines diffusion as 'the process by which an innovation is communicated through certain channels over time among the members of a social system' (Rogers 2003, p.5). A key element to this definition is the importance placed on understanding innovation diffusion as an action within a complex social system of key diffusion actors. This definition emphasizes the role played by communication, relationships and the decision making process involving acceptance or rejection across a social system.
Innovation diffusion research has a rich history, spanning more the 50 years of intense activity. The vast amount of innovation literature has led to many typologies of diffusion research focusing on the innovation process within a social system. Early research focused on the innovation adoption behavior of individuals that was criticized for being overly simplistic for interpreting organizational adoption behavior, resulting in a shift of focus towards the organization as the main unit of adoption (Nutley et al. 2002).

According to Wolfe (1994), innovation diffusion research can be split into three key typologies. These comprise: 1) Patterns of diffusion; where researchers have explored the patterns of uptake across potential adoptions and the unit of analysis of the innovation itself; 2) Organizational innovativeness: where researchers explore the determinants of innovativeness with organizations, where organizations are the level for analysis; and 3) Process theory; where researchers explore the processes organizations (and individuals) go through in adopting innovations; where the unit of analysis is the innovation process.

The type of diffusion model examined here fits the last category – process theory. There are a wide variety of staged process models proposed in the diffusion literature. However, it is argued there are significant overlaps between them (Wolfe 1994). There have also been more recent arguments over the simplistic nature of diffusion process models, with claims that innovation diffusion is a complex, unpredictable and 'messy' journey (e.g. Van de Ven et al. 1999). However, classic diffusion model supporters, including Rogers, responded to this criticism claiming a linear approach is an appropriate approximation of typical processes.

CONCEPTUAL FRAMEWORK

With this in mind, Rogers (2003) five-stage representation model of the innovation-decision process is adapted in the development of the conceptual framework proposed in this paper. Although Roger's innovation-decision process is a ubiquitous diffusion model in the general management literature, it appears to have only guided one previous study in the construction industry context (Larsen 2005). Figure 1 presents our conceptual framework.

Rogers (2003) argues the process of adoption occurs in the following stages:

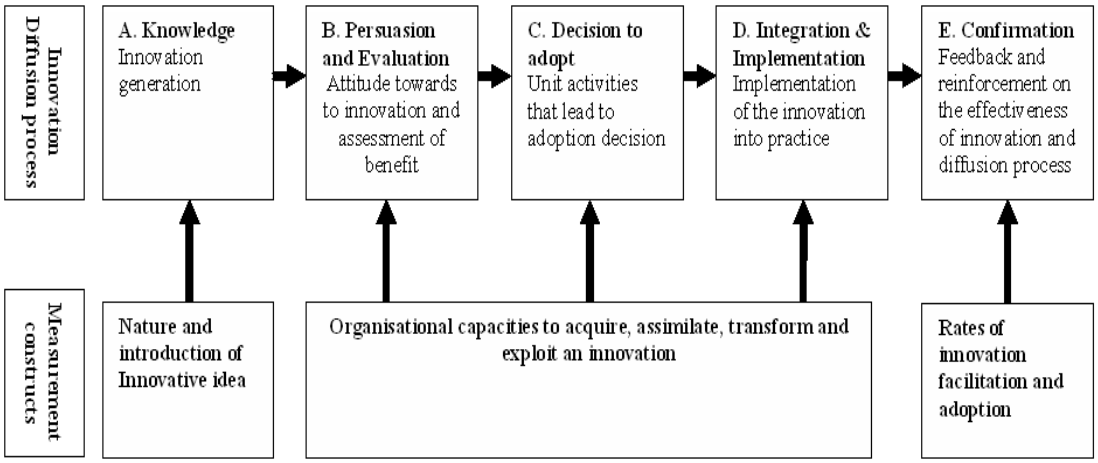
(A) Knowledge and innovation generation; where a potential adopter learns about the existence of an innovation and gains some understanding of it.
(B) Persuasion and Evaluation; where a favorable or unfavorable attitude towards an innovation is formed based on the organizational context.

(C) Decision; where activities are undertaken which lead to the adoption or rejection of an innovation.

(D) Integration and Implementation; where an innovation is implemented and/or integrated into a wider system on a larger scale.

(E) Confirmation; where information on the value of an adopted innovation and the innovation diffusion process is gathered potentially reinforcing effectiveness on a wider scale. From the innovation level, if an innovation is perceived to poorly perform or there are mixed messages of its performance, may result in the decision to reverse ongoing adoption, depending on the context.

Figure 1 Conceptual Framework



Adapted from Rogers (2003)

Rogers (2003) also argues the steps through each stage are influenced by the nature of the decision-making unit (e.g. the project team), prior conditions (such as previously standard practice and experience) and the communication channels across stakeholders. In the context of our framework, these influencing factors can be simply split into 1) the internal capability of a stakeholder organization to indentify, integrate and apply innovation in light of previous experience and practice; and 2) the inter-organizational relationships the influence the effectiveness of innovation knowledge sharing across organizational boundaries. Thus, these two elements shape our conceptual framework; influencing the effectiveness of the diffusion process.

Although Rogers's innovation-decision process theory provides a practical and generic process theory focusing on innovation communication channels as a central and critical element, it does not consider the specific context in which an innovation is diffused (Larsen 2005). Therefore, to adapt the model to the context of construction, we propose three measurements constructs namely: 1) nature and introduction of an innovative idea, 2) organizational capacity to acquire, assimilate, transform and exploit an innovation, and 3) rates of innovation facilitation and adoption.

Firstly, according to our framework 'the nature and introduction of an innovative idea' in the context of construction influences the ability of a potential adopter to learn about the existence of an innovation and gain an understanding of it. Drawing from the construction innovation literature, Winch (1998) argues new ideas stem from a 'top down' and 'bottom up' approach in construction projects: top down focuses on

a new idea adopted by organizational managers (proactive innovation), while bottom up ideas are as a result of problem-solving during a construction project in response to changing conditions that are learned later in the procurement process (reactive innovation). Also, the type of stakeholder influences the effectiveness of the knowledge and idea generation stage. Broadly, Rogers (2003) identifies the typologies of stakeholders to propose new ideas and adopt innovation can be split into five groups in order of their willingness to introduce and support the introduction of a new idea: 1) innovators, 2) early adopters, 3) early majority, 4) late majority, and 5) laggards. In assessing who are key introducers of new ideas on projects, emphasis is on 'innovator'-types, who are more willing to take on the risk of proposing a new idea for consideration, which will inform the subsequent decisions of potential adopters.
Once the new idea has been proposed, it's assessment during the persuasion and evaluation stage can be considered by the following measures (Rogers 2003): *Relative advantage*: the degree to which the innovation is perceived as better than the idea it supersedes; *Compatibility*: the degree to which the innovation is perceived as being consistent with existing values, past experiences, and needs of potential adopters; *Complexity*: the degree to which the innovation is perceived as difficult to understand and use; *Trialability*: the degree to which the innovation may be experimented with on a limited basis; and *Observability:* the degree to which the results of the innovation are visible to others. Additionally, *legitimacy* is also argued to be a driver in the persuasion and evaluation of an innovation. Thus, organizations' choice to adopt an innovation can be partly driven by institutional pressures associated with 'fads' rather than hard evidence to support their uptake (Abrahamson 1991).

In light of these theoretical concepts, knowledge and ideas generation across construction organizations is to be explored by identifying who introduces and supports the introduction of new ideas to projects, and how innovative ideas are put forward for consideration. A key feature of Rogers (2003) diffusion model is that, for most members of a social system, innovation adoption decisions depend heavily on the decisions of the other members of that system. Thus, stakeholder characteristics involved in the innovation process (and interactions between them in the organizational context) will determine early diffusion effectiveness (Nutley et al. 2002). Additionally, it is proposed this measurement construct should also identify at what stage innovative ideas are introduced (e.g. earlier during design and tender stages or informally throughout the delivery of a project).

It is useful for policy makers to understand the construction innovation diffusion process in light of its dynamic and interactive nature and the need for construction organizations to effectively communicate throughout the process for successful diffusion. In doing so, it is important to identify where new ideas originate from and how the development of such ideas can be encouraged.

Secondly, our framework proposes the persuasion and evaluation of an innovative idea for consideration, the decision to adopt, and innovation implementation is driven by internal organizational capacity across the construction network. Drawing from the construction innovation literature, knowledge flows in a construction project environment tend to be discrete and disordered causing difficulty for the organization to capture knowledge and learn from feedback (Gann 2000). Within this environment, innovation is driven by the learning capacity of organizations to identify, assimilate and exploit innovation knowledge for project specific tasks across a project network

(Gann 2001). Thus, the diffusion of an innovation (once an idea has been developed) is dependent on both the learning ability of the individual organization and the learning ability of all organizations within the project network.

This internal capacity of the organization (or decision-making unit) to evaluate, decide to adopt and then externally implement an innovation is argued to be assessed through absorptive capacity. Absorptive capacity forms a key construct in our framework as a measurement construct. This capacity refers to the learning process and ability of an organization (or inter-organizational form) to identify assimilate and exploit knowledge from its external environment (Cohen and Levinthal 1990). Zahra and George (2002) define four phases constituting absorptive capacity: acquisition, assimilation, transformation and exploitation. Acquisition refers to an organization's ability to locate, identify, evaluate and acquire external relevant knowledge to aid in the internal development. Assimilation refers to an organization's ability to understand external knowledge i.e. ability to classify and process external knowledge for internal use. Transformation refers to an organization's ability to combine newly acquired or assimilated knowledge with existing knowledge and adapt existing knowledge for new purposes. Finally, exploitation refers to an organization's capacity to take the knowledge that has been acquired and assimilated, and transform and apply it externally for indentified benefit. In the construction context, these four phases need to be understood in a project-based production environment.

Finally, once innovation is implemented, it is proposed feedback and reinforcement of the effectiveness of innovation diffusion is measured through innovation adoption activity. Innovation adoption activity can be measured by the number of construction organizations that had implemented or facilitated the implementation of innovation on construction projects. Additionally, innovation activity data will also indentify what sectors are the most active in implementing or facilitating the implementation of innovations - to provide feedback on innovation diffusion effectiveness. Although innovation activity is generally measured by innovation implementation according to the innovation implementer (e.g. ABS 2011), we propose the measure for construction innovation activity should include organizations that have facilitated the implementation of innovations. This is due to the team-based nature of construction project production (Dubois and Gadde 2002), where 'brokers' of innovation play a key role in implementation (Bessant and Rush 1995). By combining these constructs, this framework establishes a theoretical foundation for testing in fieldwork planned by the authors.

THE PLANNED EMPIRICAL STUDY

The authors, supported by both public and private sector industry partners, have been tasked to undertake a large-scale study of innovation diffusion in the Australian road construction industry, to be completed in 2013. The aim of this study will be to identify key inputs and outcome variables relating to innovative product diffusion, namely the nature of innovative idea generation, innovation activity difficulty and obstacles that restrain new product adoption. The study also aims to gather data relating to the organizational capacity to diffuse innovations on projects (including absorptive capacity) and examine the relationship between these variables towards innovation adoption. The study will contribute to the innovation literature and improve the understanding of the construction innovation diffusion process, guided by the conceptual framework developed in this paper.

CONCLUSION

The study of construction innovation is increasingly seen to require an understanding of the closely interconnected nature of the diffusion process. Thus, innovation process constructs need to be examined in a holistic manner and not in isolation to gain a more complete understanding of diffusion. This is partly due to emphasis placed on the interactive view of construction innovation that relies on the result of a team effort between a collective group of industry organizations. Thus, the focus of the process model developed here is to explore the effective integration of external knowledge sources – driven by the internal capacity of construction organizations to capture, integrate and use innovation knowledge for project benefit.

This paper contributes to understanding of innovation diffusion knowledge on construction projects, by developing a conceptual framework founded on existing diffusion process constructs from the general management literature. As guidance remains scarce on how to effectively assess innovation diffusion in specific construction contexts, the framework and proposed empirical study presented in this paper respond to this need. It is expected the framework presented here will help to reveal gaps in the knowledge flow process – from ideas generation through to implementation and confirmation - that impede the diffusion of innovation.

As a theoretical contribution, this paper proposes three critical measurements construct which can be used to inform the nature of a five-stage diffusion process. These measurement constructs comprise: 1) nature and introduction of an innovative idea, 2) organizational capacity to acquire, assimilate, transform and exploit an innovation, and 3) rates of innovation facilitation and adoption. Data obtained about these constructs in future empirical work will enable informed policy advice to effectively harness the power of knowledge networks, increasing innovation diffusion and improving project performance. The authors are planning to confirm and build upon the proposed framework and further define the critical relationships and actions required to promote innovation diffusion on projects. This empirical work is expected to assist in maximizing the potential for adoption of construction innovations in response to a growing need to deliver construction projects of increasing size and complexity.

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REFLECTIVE PRACTICE: SCOPING ITS APPLICABILITY FOR SUCCESSFUL CONSTRUCTION PROJECT DELIVERY

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ABSTRACT

This paper reports on an on-going initiative to determine the applicability of reflective practice for successful construction project delivery. There are evidences to suggest that technical rationality approaches in construction projects sometimes fail to yield desired objectives. Selective inattention, reductionism, context independency and practitioner independency are identified as major aspects of ineffectiveness in technical rationality techniques. The aim of this initiative is to introduce reflective practice as an alternative to technical rationality approaches in construction project planning. The approach is based on the belief that the complexities of construction project planning and execution sometimes require strategies that are both creative and generative. Reflective practice offers a bridge between theory and practice through practitioner engagement in a learning process that allows reflection from three different dimensions: reflection in-action, on-action and for-action. The formalization of reflective practice for project planning is based on a systematic approach which enhances the ability to interpret the interconnection of different entities connected with project planning. The study discusses how a document analysis is used to find the applicability of reflective practice and strategies on past successful projects.

Keywords: reflective practice, strategies, technical rationality.

INTRODUCTION

There is the need for philosophical changes to fill gaps between academic solutions and practical issues. According to Schon (2001, p. 186) "professionally designed solutions to public problems have had unanticipated consequences, sometimes worse than the problem they were intended to solve". Further, Dias and Blockley (1995) explain that many engineering curricular describe most physical phenomena in terms of engineering science and mathematics which leads to scepticism and that those technical rationality (TR) approaches are inadequate to handle complex situations. Thus an alternative paradigm, 'reflective practice' (RP) was introduced by Schon (1992) for practitioners. Winch (2010) suggests that construction practitioners should be reflective practitioners that could apply disciplines holistically from the inception to the completion of construction projects. The current study aims at seeking the applicability of the RP

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paradigm as a complement to TR approaches in construction project delivery. It uses a preliminary analysis of information on Construction Manager of the Year Award (CMYA) winners in the UK to show the pertinence of RP in construction project planning. The latter part of the paper describes the future study that is designed to cope with the limitations of this preliminary analysis so that a comprehensive investigation into the appropriate paradigm for project execution can be undertaken.

TECHNICAL RATIONALITY AND REFLECTIVE PRACTICE

The following treatise describes the TR and RP paradigms using their characteristics, basis, models and techniques. The information is summarised in Table 1 in line with Dias and Blockley (1995).

TR seems characterised by 'selective inattention' providing solutions for problems which can be described through theoretical phenomena only. However, most social, political and culturally soft issues, which may be the ones that mostly influence construction project success, are very difficult to describe in terms of science or mathematics (Dias & Blockley, 1995). RP on the other hand is characterised by reflective interaction as opposed to selective inattention. Thus, by reflecting in-action and on-action, practitioners become encouraged to deal with problems through a learning process that comprise a high level of thoughtfulness (Schon, 1992).

Table 1-Comparison between TR and RP

Paradigm	**Technical rationality**	**Reflective practice**
Characteristics	Selective inattention	Reflective interaction
Basis	Science (Analytical, Reductionist, Context independent and Practitioner independent)	Systems (Synthetic, Holistic, Context independent and Practitioner dependent)
Models		
Grounding	Truth	Dependability
Specification	Precision	Appropriateness
Improved by	Calibration against world	Comparison with world
Techniques	Mathematics	Artificial intelligence

(Source: Dias & Blockley, 1995)

On the basis of these paradigms, Dias and Blockley (1995) explain that TR provides a reductionist approach to issues. Thus, TR inspires practitioners to provide answers by dividing the whole into parts. However, one may ask: can those separate parts replace or even explain the whole? For example human beings are able to talk and walk due to cooperation amongst the sub-holons that make up the body, but these sub-holons themselves do not have those abilities (Dias & Blockley, 1995). In construction, project success could be explained by the sub-holons of time, cost, quality etc. However, if one considers one dimension separately, projects may fail in other dimensions. Conversely holism, which is the basis for RP, emboldens practitioners to think about entities both as a whole and in parts (Dias & Blockley, 1995). This encourages project managers to have a global understanding of the effects of an action or decision on, not only one part of the project, but other parts as well. According to Rand (2000), this includes considerations for all project objectives in terms of cost, time and quality towards the achievement of successful project outcomes. Further, Rand (2000) opines that it is necessary to understand the basic behaviours of any project management environment before decision making. This limits the TR paradigm in its application because it is

both context and practitioner independent (Dias & Blockley, 1995). No doubt that construction project achievement (success or failure) is highly influenced by project managers and the team involved in its execution (Bourne, 2007). RP therefore finds relevance as it requires practitioners' artistry to tackle with real world problems (Dias & Blockley, 1995).

An examination of the nature of current planning techniques gives further credence to the limitations of TR approaches. Considering the trend for management tool development, we posit that some of these tools are sub-optimal and a complementary approach in the form of RP may provide significant benefits to construction practitioners. Table 2 provides information on the nature of TR in planning tools such as: Critical Path Method (CPM), Program Evaluation and Review Techniques (PERT), Critical Chain Planning Method (CCPM) and Earn Value Management (EVM). Specifically their nature is explained under TR deficiencies: Reductionism (R), Selective Inattention (SI), Context Independency (CI) and Practitioner Independency (PI).

Table 2: TR natures in current planning tools

	CPM/PERT
R	Managing time, quality and cost as separate sub-problems and violating other requirements when one sub-problem is addressed. Considering non-critical activities separately may cause them to happen in critical path later.
SI	People's attitudes such as 'student syndrome' cannot be formalized.
PI	Activity durations are based on probabilistic mathematical procedure. Practitioners are not encouraged to use their judgment and experience.
CI	Nature of the activity, construction pace and site conditions are not considered.
	CCPM
R	Quality considerations must be considered separately.
SI	Though constraint removal is stepped down, identifying constraints and taking decisions demand practical skills in-addition to engineering knowledge.
PI	Buffer calculations are dominated by probability based mathematics.
CI	50% duration from the sum of critical activities is added as the project buffer without considering actual risk levels.
	EVM
R	No way to count the whole effect of Cost and schedule variances.
SI	Difficult to find the optimum time for performance calculations based on theories.
PI	Variances are predicted from monitoring records, practitioners work as calculators.
CI	Predictions do not consider wavering progress in projects.

R - Reductionism **SI** - Selective Inattention **PI** - Practitioner Independency **CI** - Context Independency

Further, there are efforts to achieve success by facilitating decision making through models and generic algorithms. Those decision support models seem to address only selected issues (again a reductionist approach), hence sub-optimal. Underhill (1994) concludes that the reliability of computer programs to implement heuristic procedures is low, some occasionally provide correct solutions but with grossly sub-optimal results.

Based on the above treatise, the current study intends to proffer solutions in line with the philosophical change encouraged by Dias and Blockley (1995) and similar studies.

It is one aspect of a doctoral programme that seeks appropriate strategies for construction project planning.

RESEARCH METHODOLOGY

The study comprises a document search and analysis of archival information provided by the Chartered Institute of Building (CIOB), UK on Construction Manager of the Year Award (CMYA) winners. Archival analysis research strategy is a way of arranging and analysing archives and is suitable for the current inquiry due to three reasons: the researchers did not need to control actual events, the questioning type was based on 'what', and the study investigated past events (Yin, 2003).

The CIOB represents a whole range of construction professionals including but not limited to project managers, designers, developers, client organisations (CIOB, 2010). Qualitative information on winners of the Construction Manager of the Year Award (CMYA) was filtered through to determine common themes relating to two issues: 1/ what makes construction project implementation challenging (identification of problems) and 2/ what are the approaches that could help to overcome these challenges and achieve ultimate success (providing solutions). Awardees profiles were collected for the period from 2009 to 2011 and resulted in a total of 66 Construction Managers and 66 projects for the study.

NVIVO 9 software, a qualitative research tool for data sorting and analysis, was used for data sorting while analyses of the relevant information were done manually. The NVivo software required the creation of parent, child and sub nodes respectively to facilitate collation of similar themes within the archival information provided. Figure 1 gives a screen shot of the different nodes created and their arrangements for the study. The representation of the various nodes is explained later.

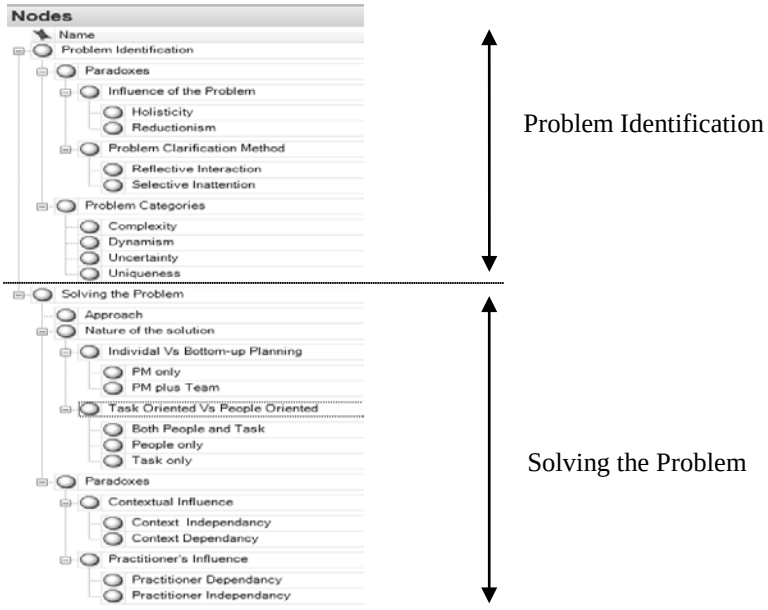


Figure 1: Arrangement of nodes in NVivo 9

RESEARCH FINDINGS

What make construction project implementation challenging?

The first aspect of the analysis was aimed at determining what made construction project implementation challenging. Archival information provided on the award winners (CMYA) was sorted using NVivo nodes. The parent node created was

'problem identification' and consisted of two child nodes, 'problem categories' and 'paradoxes'. The 'problem categories' child node was further divided into four sub-nodes: complexity (difficulty in grasping due to complication), dynamism (sudden changes to project activities), uncertainty (unpredictable/unexpected project events) and uniqueness (novel approaches to project performance). Similarly, the 'paradoxes' child node was divided into two sub-nodes named 'influence of the problem' (reductionism (R) versus holisticity (H)) and 'problem clarification method' (selective inattention (SI) versus reflective interaction (RI)). The following definitions explain the paradoxes.

SI - Problem could be explained by using engineering theory and historical data

RI - Problem could not be explained as a theoretical formation

R - Problem could not be considered separately (as a part only) without considering its interrelationship with other activities (as a whole)

H - Problem could be dealt with separately

Following the creation of nodes and sub-nodes, it was possible to determine the frequency of occurrence of each nodal theme within the archival information provided (CMYA award statements). The scope of NVivo software was limited to data sorting, thence manual interpretation was required to categorise issues under the different nodes and sub-nodes.

First, the project challenges/problems were categorised under complexity, dynamism, uncertainty and uniqueness. The frequency counts and percentage occurrences for each year are summarised in Table 3. From the table 3, it is observed that out of the 66 projects studied, only 5 projects (8%) had no project information that could be placed under the four sub-nodes and therefore unrelated. Of the remaining 92% of projects, both complexity and uncertainty generated the highest frequencies (67 and 61% respectively). Dynamism and uniqueness also provided challenges to project realisation within 36% and 17% respectively of the total projects studied.

Table 3: Characteristics of CMYA award winners' projects

Characteristics	2009	2010	2011	Total (%)
Complexity	15	15	14	44 (67%)
Dynamism	14	6	4	24 (36%)
Uncertainty	18	15	7	40 (61%)
Uniqueness	5	3	3	11 (17%)
Unrelated	2	2	1	5 (8%)

Considering the identified paradoxes of the study, the first paradox (reductionism versus holisticity) helps practitioners to identify if it is important to see issues both as a part and a whole. While the second paradox (selective inattention versus reflective interaction), would indicate the importance of problem clarification by using either theoretical concepts or reflection in and on action. In 66 projects, it was possible to identify 136 issues and solutions provided by the CMYA awardees. The summary is presented in Table 4.

From the 2nd to the 5th columns, the frequency counts of the two paradoxes depict the actual nature of problems in the industry. It seemed that major issues encountered as barriers for the CMYA project implementation could not be described through engineering theoretical formulations. Out of 136 issues, 132 issues (97%) seemed to be understood through reflective interaction. Only 3% of issues appeared to be clarified purely through engineering science. Regarding reductionism versus holisticity, 28% issues looked likely to be solved as separate problems without considering its

consequences on other activities. However, the majority of problems (72%) appeared to interrelate with succeeding and parallel activities.

Table 4: Project evaluation by paradoxes

Year	Problem				Solution			
	SI	RI	R	H	CI	CD	PI	PD
2011 (n=33)	0	33	6	27	0	33	0	33
2010 (n=56)	3	53	17	39	3	53	1	55
2009 (n=47)	1	46	15	32	1	46	1	46
Total (n=136)	4	132	38	98	4	132	2	134
As a % (n=136)	3	97	28	72	3	97	1.5	98.5

What are the approaches that can help to overcome challenges?

For the identified 136 issues, solutions provided were reviewed and sorted under the 'approach' node. To overcome challenges and hence to achieve success, the award statements mentioned project strategies as the construction managers' approach. Considering that strategies aim at coping with messy situations, the term 'strategy' could be defined as 'that which assists the construction manager in decision making and problem solving within the complexities, uncertainties, dynamisms and uniqueness of the construction process'.Then, strategies were sorted under two paradoxes: Context Independency (CI) versus Context Dependency (CD) and Practitioner Independency (PI) versus Practitioner Dependency (PD). The following definitions clarify the paradoxes.

CD - Solution created is specific to the project context
CI - Solution created can be applied generally to any project context
PD- Solution created had an influence from practitioner's creativity and experience
PI - Solution was straightforward and based on theoretical knowledge.

The resulting frequency count is shown in the last four columns of table 4. On observation of the result, one could see that context dependency and practitioner independency (97% and 98.5% respectively) dominated in strategic solutions over context independency and practitioner independency (3% and 1.5% respectively). The result shows that it is important to include contextual and practitioners' effects in a reliable planning approach.

After that, the CMYA award statements were reviewed for the natures of strategies. First, strategies were categorized under the controversy of 'individual decision making' (project manager only) versus 'bottom-up planning' (project manager with the team). Individual decision making is a characteristic of the TR paradigm as opposed to bottom-up planning in the RP paradigm (Dias, 2002). Here, the 'team' means every stakeholder except the project manager, including client, design team, sub-contractors and specialists. 'Bottom-up planning' is not to be confused with stakeholders' positions, but it describes the nature of problem solving: getting strategic direction from the team and developing them by the project manager. According to provided information on 136 strategies, in 71 strategic solutions (52%), project managers seemed to craft strategies by themselves and in 65 incidents (48%), they demanded suggestions from their teams.

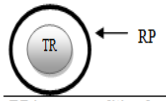
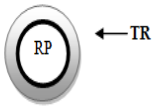
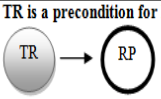
The second controversy is relevant to strategy focus. The RP focus is on people and the TR focuses on tasks (Dias, 2002). Out of 66 CMYA projects, 55 projects (83%) were implemented by using the combined strategies of people and task oriented. From the

rest, 9 projects (14%) mentioned about task oriented strategies only and 2 projects (3%) used people oriented strategies only.

DISCUSSION

Investigation on the paradoxes shows that it is necessary to develop approaches having feasibility to consider contextual backgrounds specific to project environments. The result further encourages practitioners to identify problems based on reflective interaction in addition to theoretical knowledge. The CMYA descriptions showed that holistic view can be applied to construction projects in different ways. The holism of the ultimate end result means that projects should achieve considerable outputs in all dimensions. However, that does not mean that achieving all objectives in each and every activity is a must. It can be seen as a reductionist attempt since an activity is considered separately from other activities. For example, changes to the construction method of an activity may cause program gain but less profit margin or losses. However, the overall effect may still be worthy when consequences are counted on interconnected activities. Further, project managers may recover any profit deficit by using value adding techniques for other activities. Not only in tasks, but also even in stakeholder responsibilities, holistic thinking seems to be important. For example, the award statements mentioned considerable cost and time variations in projects. According to contractual obligations, contractors could claim those variations from clients. However, in those situations, CMYA awardees used value adding strategies to cut the total cost and give resulting benefits to clients to ensure that projects could be run within the same budget. That kind of thinking can result in indirect advantages such as ensuring smooth cash flow, winning clients' commitments and getting future business opportunities to work with the same client.

Table 5: Relationship between TR and RP in construction project activities

Activity	RP		TR		Relationship
	Reflective interaction	RP technique	Focus of attention	Scientific/ Mathematical technique	
Selecting construction materials	Ease of construction, availability, suppliers' certainty, discounts, credit facilities	Experience, technical skills, information handling skills, etc.	Quality level of materials	Referring standards of the materials, testing, etc.	TR becomes the context of RP 
Calculation of activity duration	Working space, material supply, plant capacity, uncertainties, etc.	Experience, technical skills, conceptual skills, etc.	Measuring quantities of work, relationship between number of hours, quantity and hourly output	Basic mathematics such as addition, multification and division	RP is a precondition for TR 
Choice of a construction method	Noise, vibration, interruption, space requirements, etc.	Experience, technical skills, communication skills, etc.	Cost optimization	Cost-benefit analysis	RP is a constraint for TR 
Rescheduling	Finding causes of overruns, getting corrective actions, etc.	Experience, conceptual skills, information handling skills	Referring to progress records such as grant charts.	MS Project	TR is a precondition for RP 

Further, the result shows that strategic solutions have natures from both paradigms. Dias and Blockley (1995) say that the two paradigms are not independent, but are related in three ways: TR becomes the context of RP, RP is a pre-condition for TR and RP is a constraint to TR. Table 5 shows these three relationships plus an additional relationship showing that TR becomes a precondition for RP. One should note that the relationships depend on practitioner's behavioural sequences. For example, if a practitioner pre-uses CPM data and equations to find out issues in the programme to

create solutions, TR can be considered as a pre-condition for RP. However, if that practitioner predicts possible consequences prior to the occurrence and thence use CPM to make revised program RP becomes a precondition for TR.

Although strategies and both the TR and RP paradigms were mentioned as the causes of successful project implementations, it was difficult to quantify their effect on project implementation. The limitation suggests further studies, which is planned to be progressed under the larger doctoral study that this paper is based on. Influences from strategies and the paradigms are to be investigated through hypotheses verification by using a questionnaire as the research strategy. If correlations are considerable then the study will further focus on creating strategy models for construction project planning. For the proposed study, the participants will be the construction excellence award winners selected by the New Zealand Institute of Building (NZIOB) from 2001 to 2011.

CONCLUSION

Construction projects report cost and time overruns, quality failures and owner dissatisfactions regularly. This study shows that current planning tools are characterised by TR dominated natures such as reductionism, selective inattention, context independency and practitioner independency. The analysis of information on Construction Manager of the Year awards shows that a combination of both RP and TR paradigms could ensure project success. Strategies appear to be the approach to practice this emergent paradigm. Further, the study recognizes that it is important to make decisions both in individual and group basis. Planning tools like CPM and PERT consider only tasks, but the study shows that both tasks and people must be the basis of a reliable planning approach. The current study investigation could not quantify the effects (as high or low) of strategies and the two paradigms. Therefore further studies will focus on this limitation as well as strategy modelling to help the industry to achieve project deliverables in a more reliable manner.

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SHOULD COST MODELLING – A NEW DESIGN DEVELOPMENT MANIFESTO

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ABSTRACT

The traditional approach to cost modelling in the UK construction industry consists of a bottom-up cost estimate based on the proposed design, followed by a value engineering exercise to bring that cost estimate closer to a pre-set development budget. As a result of this approach, the design team is unaware of the pre-set development budget constraints, which frequently results in a costly re-design process. This traditional, reactive approach to cost modelling and design development is progressively being replaced by a proactive, top-down form of cost analysis that influences the entire development process. The "Should Cost Model" precedes the design, allowing the overall cost plan to progress in parallel with the design development and ensuring that resources are allocated where they generate greatest value. By establishing key commercial success criteria and efficiency ratios for all asset components, this new tailor-made cost model informs the budget for each asset component. Should Cost Modelling has the potential to revolutionise construction design methodologies by establishing a basis for design and future design variances to be monitored against.

Keywords: Design Development, Should Cost Modelling.

INTRODUCTION

The principles of contemporary cost management systems in the UK construction industry are deemed by researchers to be very similar to the ones that have been used since the mid-1920s (Johnson and Kaplan 1987). These principles centre on cost consultants pricing architects' design, i.e., establishing how much the project 'will cost'. This approach yields a bottom-up cost estimate based on design; an outcome of design approach (Ballard 2006). Such cost estimates are usually greater than the client is able to, or should, pay, and clients who reject them typically then instigate a value engineering exercise to bring that cost estimate in line with their pre-set development budget. Thus begins an iterative process of re-design and costing, ending when there is an acceptable fit. This cycle of design and estimation -- or re-design and subsequent cost estimate revision -- is nowadays considered to be inefficient, reducing the value that can be profitably delivered to construction clients (Theodorakopoulos 2009). Moreover, this traditional, backward-looking, 'will cost' methodology has become inappropriate for managerial purposes, in the post-crash commercial

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landscape, because 'will cost' information tends to be too late, too aggregated and too distorted to be relevant for project planning and control (Johnson and Kaplan 1987).

Some recent Finnish academic literature has proposed that designing to cost targets – Target Costing - maximises value for construction industry clients. Target costing is in widespread use in Finland (Pennanen, et al. 2011).

Similar to the Finnish Target Costing method, EC Harris LLP, a leading global Built Asset Consultancy, has developed an alternative to 'will cost' management methodology both in the UK and internationally. This alternative maximises clients' Return on Investment (ROI) on built assets. It is a specialised form of cost analysis which is essentially a Should Cost Model, tailored to the distinct circumstances involved in construction design and delivery processes, and focused on ensuring that cost decisions are linked to income and value. Should Cost Modelling is a design steering tool that enables monitoring of, and challenges to, the design development process, ultimately maximising value to the client.

RESEARCH METHODOLOGY

The starting points in this research were cost modelling issues faced by the wider construction industry in the UK, and her professional experience with an innovative solution. The primary purpose of this research was the documentation and interpretation of the Should Cost Modelling methodology for the advancement of knowledge, and included a review of three confidential case studies. The results of this research describe a unique EC Harris LLP design-steering method, which allows management of the design process toward a set value target for the project.

The following research methods have been carefully selected for this study: literature review and case studies analysis. This study has two phases: 1) an investigation of existing research into design steering; and 2) exploration and interpretation of three case studies. In phase one, the literature review focused on research in the field of cost and design management, with particular emphasis on literature concerned with design steering, lean costing and target costing. The literature review was chosen as the starting point of this research and the intention was to establish subject background, learn from other research, formulate research problems, synthesise the work of others, and compare with other research strategies (Ridley 2008). In phase two, the findings of the literature review were compared with and used to analyse three confidential case studies and the Should Cost Modelling methodology practised by EC Harris LLP.

SHOULD COST MODELLING BACKGROUND

One of the first known references to the Should Cost method is found in the US Army Materiel Command (US Army Procurement Research Office) Should Cost Analysis Guide (1972). This Guide believes that Should Cost began as a civilian application, with a large, nationwide consumer goods chain applying the method to the suppliers of its appliances, hard goods, and other items. The method has been successful in obtaining consistently low prices from the suppliers (USAMC 1972). Based on this observation, in 1967 the US Department of Defence, following runaway cost overruns on many military programs that generated severe criticism in the public press and continual debate in the Congress, implemented a programme to aggressively apply and expand the Should Cost methodology on major procurement programmes. The

results proved that the Should Cost approach brings significant cost savings and long-term management improvements (USAMC 1972).

At present, Should Cost is used to describe a variety of approaches to pricing. The National Society of Cost Estimating (1986) defines it thus: 'Should Cost is a concept of contract pricing (…) to identify uneconomical or inefficient practices in the contractor's management and operations, to quantify the findings in terms of their impact on cost, and to develop a realistic price objective for negotiations (…)'. According to Sourcing Innovation (2010), '[Should Cost] knowledge is critical for identifying mis-priced parts, parts with high mark-ups, parts improperly sourced from vendors who are not suited to produce the part, and overly complex parts in need of simplification and re-engineering' . In line with these various definitions and applications, there are various recognised approaches to Should Cost modelling, including Should Cost Modelling based on industry averages, sequential, bottom-up strategies, top-down strategies, cooperation models, negotiation models and combined negotiation and cooperation models (iprocurement 2011).

The EC Harris LLP proposal for the construction industry is a top-down form of cost analysis based on benchmark data. The aim of the proposed Should Cost Modelling is to provide an initial indication of the current out-turn costs of the development that has been derived from benchmarked data from final accounts and priced cost plans (ECH 2011). Should Cost Modelling is used by EC Harris LLP as a design management tool for reducing the cost of the product and identification and protection of value. This approach is based on Tanaka's (1993) proposition that the cost of the product is considered to be an important strategic factor that should be decided by management, not designers. Should Cost Modelling is based on a desired functionality and performance instead of on proposed design.

SHOULD COST MODELLING METHODOLOGY

The Should Cost Modelling methodology provides a robust platform and commercial strategy to deliver predictability of outcomes at all stages of the design and construction. It revolves around the establishment of a robust commercial platform (baseline) and commercial success criteria for delivery of projects and programmes of work, at the earliest opportunity. The Should Cost Modelling approach allows the overall cost plan to progress in parallel with design, as well as to ensure that resources are allocated where they generate the most value.

Should Cost modelling permits:

- creation of a cost model to reflect the minimum achievable cost-to-deliver products that meet the brief(s),
- identification of extra costs for specific site conditions and constraints
- all enhanced design over the base to be approved on a business case basis
- establishment of key efficiency ratios for all asset components
- establishment of the basis against which future design variances can be monitored
- identification of value management opportunities to meet or better the should cost basis
- identification of risks and opportunities
- review and sign off of spend / design decisions with the client

- development of an informed budget for each asset component

EC Harris LLP's Should Cost Modelling methodology has three distinct steps shown in the Table 1 below.

Step	Question	Solution
1	How much would the optimum product cost, given perfect conditions?	The creation of a Zero Cost Model – a theoretical cost model with no external influences or abnormalities
2	How much should this product cost given all known conditions?	The creation of a Should Cost Model – a theoretical cost model overlaid with all known external influences
3	Testing of the Cost Estimate against the Should Cost, thus challenging and maximising value.	The creation of a Cost Estimate – a cost estimate which includes value and income driven decisions

Table 1 – Should Cost Modelling methodology

The Should Cost Modelling adds value to the client by making transparent the differences between stages: e.g., why the delivery of Zero Cost optimum product is not possible or desirable, why the Cost Estimate differs from the Should Cost, and what value and income decisions were made to arrive at the Cost Estimate.

For example, in line with the initial Zero Cost Model, there might be an allowance of £500 per m^2 for the cladding, but the Should Cost Model would take into consideration a planning requirement for an enhanced façade, and increase the cladding allowance to £600 per m^2. The resulting final Cost Estimate could also contain a further allowance of £100 per m^2 for special cladding to appeal to a certain type of tenant. The Should Cost Methodology transparently identifies – and more importantly, *explains* – these differences, arming the client with the right information at the right time to facilitate decision-making. It also informs the basis of the design (client's brief) and the design team's development of detailed design proposals.

From a cost management perspective, the main difference between Should Cost Modelling and traditional cost-estimating is that Zero Cost and Should Cost allow the client and his teams to understand the basis of the Cost Estimate. It also allows for project-specific circumstances (project abnormalities) to be incorporated into the ideal (Zero) position resulting in realistic (Should) position. This in turn allows the client to judge emerging design proposals and associated cost estimates on their objective merits to see if they would add value to the project.

THE CREATION OF A ZERO COST MODEL

The Efficiency Database of EC Harris LLP, one of the largest cost consultancies in the world, provides valuable benchmarking data (such as value, function, time, and design and cost efficiency) from every project. This data creates the starting point for project cost estimation - an ideal Zero Cost Model. The creation of a Zero Cost Model follows a three step process, shown in Table 2 below.

Step 1	Data stored in the efficiency databases informs the benchmark cost model.
Step 2	This data is updated for each cost model, taking into consideration the optimum parameters for its particular function (typically consisting of commercial metrics, energy performance, project performance, variance to statutory benchmarks).
Step 3	This data is tweaked to create the optimum product available. Taking the example of a commercial office building, the likely functional efficiencies that would be transformed to optimum would be the nett to gross ratio, façade cost/m^2, programme/m^2 built, MEP cost vs. occupancy density, reception costs vs. reception area, riser/plant areas, preliminaries/area, wall-to-floor ratio, glass-to-solid ratio, preliminaries/week, WC costs vs. occupied area, cost of façade vs. wall to floor ratio, BREEAM/LEED ratings, cost/per m^2 floor plate and many other aspects of the development.

Table 2 – Zero Cost Modelling sequence.

The key cost influencing factors, such as architectural intent, procurement and buildability are not included in the Zero Cost Model; only the most efficient design for its particular function is allowed for.

Once the above three steps have been completed the end result is a Zero Cost Model for a hypothetical building, based on must-have, extreme functional efficiencies and no external influences (such as shape, size, planning, rights of light, site constraints or existing conditions). The Zero Cost Model is therefore not an estimate per se, but the optimum outcome for a project if all influencing conditions were perfect.

THE CREATION OF A SHOULD COST MODEL

To create a 'live' cost model, the Zero Cost Model has to be overlaid with project-specific details and circumstances. This exercise usually involves updating cost information with inefficiencies driven by the site constraints, client brief, commercial business case, budget, design criteria, functional efficiencies, pricing levels, construction, statutory implications and any other known influences on the end product. Architectural intent, buildability issues and selected procurement strategy are taken into account at this stage. The end result of this exercise is a Should Cost Model detailing how much a particular building *should* cost, based on all external circumstances.

THE CREATION OF A COST MODEL

The beginning of the design development process also marks the start of the evolution of the Should Cost Model towards a Cost Estimate. At this stage the value of the Should Cost Model becomes apparent, as the subsequent estimates are constantly evaluated against the model's development baseline. As the design progresses, this comparison exposes inefficiencies or deviations from the Should Cost Model, and allows assessment of their impact on and value-add to the project.

In parallel with the evolution of the design, the original Should Cost Model is updated to reflect other essential project activities, such as market testing or the quantification of risks. All these activities feed into the cost estimate as part of the estimate testing cycle against the Should Cost Model until the actual Cost Model (project cost estimate) is completed.

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THE VALUE OF SHOULD COST METHODOLOGY - REVIEW OF CASE STUDIES

Three case studies were used in this research – two confidential large, complex mixed-use schemes located in the UK (£4bn and £411m) and one confidential project located in Middle East (£undisclosed). In each case the Concept Design Order of Cost Estimate (Cost Model prepared at RIBA Stage C) was prepared using Should Cost Modelling methodology. The estimate was prepared on the basis of the building areas assumed by the architect within their Concept Design submissions. Composite rates per m^2 of built area were generated from EC Harris LLP's in-house database system, which provides final costs on all projects that EC Harris LLP has delivered in a particular region. All rates were amended to reflect current market conditions (e.g., commodity prices and labour markets) which are tracked by the EC Harris LLP research team on an ongoing basis. Where information was not available, lump sum allowances were made and subsequently refined. The focus of the Concept Design Order of Cost Estimate was to provide an initial indication of out-turn cost on the development that has been benchmarked against the final accounts of previous and similar projects.

In all three case studies, the Should Cost Model identifies targets that have to be achieved to maximise return on investment. This resulted in, for example, additional extra over-costs associated with the residential specification uplift and the façade uplifts called for within the clients' brief. The Should Cost Model also identified key components that require review in structured workshops to ensure that the approach of 'design-to-budget' is maintained (e.g., basement and car parking, lighting options, ratio of gross to nett lettable floor areas, external landscaping, façade specifications, LEED and environmental strategy review, MEP strategy review, interior options or traffic study review). The project teams were provided with a clear understanding of the cost to develop the scheme and the model informed the setting of the client's brief.

The design 'steering' provided by the Should Cost Model allows the design team to ensure that the project costs either equal or better the budget (all three case studies are now at RIBA Stages C+ to E). The design teams involved in the case studies recognise that there are many possible design solutions for each project definition, resulting in a variety of building costs.

CONCLUSIONS

The Should Cost Modelling concept is already in use by EC Harris in the construction industry in the UK and internationally, with encouraging results. In the three case studies reviewed, this methodology provided design steering and helped mutual understanding among designers, cost consultants and clients, enabling achievement of target costs and purposed value for the clients. The main limitation to the wider adoption of top-down cost management methodology in the UK construction industry such as Should Cost Modelling seems to be the cultural change required to replace the entrenched 'will cost' approach. As observed in Finland, where a form of top-down costing methodology (Target Costing) has been used since the 1980s, architects initially resisted the new approach, thinking that the design is "right" in and of itself and that any challenge and/or change to a proposed solution due to set cost targets was "wrong". But in 2011, Finish researchers reported that most Finnish architects

now require well-analysed target cost information before commencing design work, proving that the top-down approach also benefits the design process (Pennanen, et al. 2011).

Broadening the use of this methodology in the UK would probably require incorporation of the Should Cost Methodology into the RIBA's Plan of Work, with the Zero Cost Model and Should Cost Model written into the detailed description of project stages as exemplified in Table 3 below.

RIBA Stage	Description and activities
Stage B	• Development of initial statement of requirements into the Design Brief, by or on behalf of the client, confirming key requirements and constraints. • Identification of procurement method, procedures, organisational structure and range of consultants to be engaged for the project. • **Output: The creation of a Zero Cost Model**
Stage C	• Implementation of Design Brief and preparation of additional data. • Preparation of Concept Design including outline proposals for structural and building services systems, outline specifications. • **Output: The creation of a Should Cost Model**
Stage D	• Development of concept design to include structural and building services systems, updated outline specifications. • Completion of Project Brief. • **Output: Cost Estimate**

Table 3 – Should Cost Methodology incorporated into RIBA Plan of Work. Based on RIBA Plan of Work (2008)

The findings of the case studies reviewed suggest that greater transparency on goals, processes and information models of clients is needed to support the commitment of design teams to Should Cost driven design processes. A valuable area for future research is therefore cost model design steering and design-to-cost targets.

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UNDERSTANDING INNOVATION MANAGEMENT IN THE CONSTRUCTION INDUSTRY

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ABSTRACT

There has been a long history of criticising the construction industry for its lack of innovation as a source of competitive advantage. However, some recent literature argues that the problem is not that there has been no innovation indeed the industry is a source of new ideas. Through a literature review it was found that the problem with managing innovation in construction has its roots in misconception of innovation. Despite many attempts to develop a model to understand the innovation process in the construction industry, no one model adequately addresses all the need of the process of innovation at an organisational and particularly project level context. In this critical review, the literature on innovation management in the construction industry is reviewed with a view to inject a fresh perspective of the problem. A case is made for the need for deep attention to strategic management as the foundation for innovation in pursuit of competitive advantage and how innovation as a part of strategic thinking of an organisation could motivate participants involved in construction projects to innovate.

Keywords: construction industry, innovation management, strategy.

INTRODUCTION

The low level of innovation within the construction industry has been a source of discussion between scholars. Many researchers considered the construction industry as an old and backward industry (Woudhuysen and Abley 2004) and criticised it for lack of innovation. However, few authors argued that the image of the industry as lacking innovation seems unfair (Ozorhon et al. 2010) and the industry is "a source of lively new ideas" (Winch 1998). On the other hand, the problem is the rate of innovation which lags behind. Innovation has been long recognised as a source of competitive advantage (Ozorhon et al. 2010, Stewart and Fenn 2006, Thomson 2006, Porter 1998). It is generally regarded as a way to increase productivity and quality in the construction industry (Barrett and Sexton 2006). Therefore the wisdom of low rate of innovation could justify the need for improvement of construction project performance in terms of quality and product functionality. Through this review, it was found that there is lack of research on strategic approach to innovation in the construction industry.

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This paper reviews the construction innovation literature, and examines implementation of innovation theories in construction. This paper discussion is organised in three sections. Firstly, trend in research on construction innovation are traced from three most highlighted view of construction innovation. Secondly, the importance of competitive advantage approach is highlighted. Finally, this review calls for limitation on strategic thinking as a motivation for innovation and the importance of client's role in stimulating the players involved in the construction industry to innovate.

TRENDS IN RESEARCH ON CONSTRUCTION INNOVATION

A review of innovation concept within the construction industry

"Ideas are intangible assets locked in human minds taken to mean the starting point for innovation" (Kim 1999, Barrett and Sexton 2006). Intangible activities are not simple to manage even in an ideal organisation. The process of bringing ideas into practice called 'innovation' (Robinson Fayek et al. 2008). Innovation in general term is defined as a process of adapting/adopting new knowledge into new products, processes or services (Johnson et al. 2008, Ozorhon et al. 2010). In addition, it is regarded as a complex and multidimensional process and totally people-centred process. It is mainly because of complexity in behavioural and cultural change within an organisation which is much difficult aspect of innovation than hardware amendment (Rothwell 1992). There is still no precise prescription or recipe for successful innovation and no one model can adequately address all the needs of the process of innovation whatever the context (organisational, project-based industries) (Thomson 2006, Tatum 1984).

Taking these explanations into account, there is no generally-accepted definition on innovation in the Construction Industry. Scholars have different views on this concept. The context of construction innovation has been discussed in different categories depending on the level of focus from where the research stems for example material or method. The similarity and often confusion in practice of the terms *invention*, *change* and *problem solving* have been also discussed by many authors and distinguishes made from innovation i.e. (Tatum 1987, Slaughter 1998, Johnson et al. 2008). Barrett and Sexton (2006) by studying seven small construction firms concluded that practitioners define successful innovation as: "the effective generation and implementation of a new idea, which enhances the overall organisational performance". Although, the generalizability of this concept has not been confirmed.
Scanning the literature, innovation in the construction industry mainly arises from three domains: Product, process and organisation. Moreover, many discussions have been made based on three main categories: 1) Its typology 2) An institutional viewpoint i.e. (Latham 1994, Fairclough 2002, Egan 1998) 3) An organisational viewpoint (i.e. top-down innovation and bottom-up innovation)

Typology viewpoint

The example of innovation typologies is Slaughter (1998) who has provided a set of models of construction innovation to what she believes reflect the nature of the construction industry and activities of specific construction companies. The proposed models are incremental and radical innovations, modular and architectural innovations, and system innovation. She argues that much of the research concerning innovation within construction is based on examples of the manufacturing of products for the industry. Consequently, it remains a failure to assess innovation within the

context of construction as a mode of production. Even although the products produced are for construction, the process of innovation tied to the principles and production methods of manufacturing. It could be argued that the interaction of innovation within the context of the construction environment is neglected.

Institutional viewpoint

Another perspective of innovation within the construction industry is observed at institutional level. In the UK, the improvement of construction innovation has been set as a government agenda for example the Egan report titled 'Rethinking Construction' published in 1998 to address the wider competitive problems followed by the Fairclough report in 2002. As opposed to the Egan report, Winch (2006) states that the approach tends to be process oriented and ignores the product, particularly the way in which it generates value for client. However, the Fairclough report with its different approach focuses on university sector and the construction industry reveals the poor level of R&D and gives evidence that construction industry and university sector have been poorly coupled. It could be argued that the attempts in institutional viewpoint of construction innovation highlights the typical characteristics of the industry such as its immobility, complexity, durability , costliness and high risk of failure as a barrier to innovation. Although the institutional view point of innovation is essential, it is necessary that to increase the focus on more practical level of construction innovation.

Organisational viewpoint

The organisational viewpoint of construction innovation exists to examine the practical role of organisation and firms within innovation process. A few authors raised the point in hierarchical approach (top-down and bottom-up) to examine the challenges and opportunities to stimulate implementation of construction innovation (Winch 1998, Slaughter 2000). In addition, other related research area were also discussed including identification of effect of organisation environment with firm size on innovation management (Sexton and Barrett 2003); study of organisational culture and structure in decision-making and implementing of innovation (Nam and Tatum 1997) and finally investigation of barriers and factors to innovation by comparison to manufacturing (Van de Ven et al. 2000).

CONSTRUCTION INNOVATION IN PRACTICE

Understanding the realities of innovation within construction projects requires understanding both nature and variation of innovation (Thomson 2006). It has been stated that within the context of the construction *organisation,* it is possible to discuss innovation as existing similar terms whereas using *product* and *process* term within construction *project* context is not easy. Thomson (2006) mentions that the traditional understanding of *product* innovation is that it is product led. This is apparent in manufacturing firms and is evident within context of construction *organisations*. However, it becomes inappropriate with regard to the construction project. This is because of the typical characteristics of construction projects. The Construction industry is mainly a site operation and does not have the advantage of production process and mass-production system. The high level of product complexity and failure risk creates the need for various specialised professionals, which results in a fragmented environment. The product in the construction industry is novel with separated product design function and production. Moreover, the nature of construction products is costly with high level of responsibility involved, which leads

to discouraging the implementation of trial-and-error as a main driver of innovation. A construction project is by comparison client led, in that its demand stems from specific need identified to the project team by the client (Salter and Gann 2003) whereas a construction organisation can peruse a product innovation through its presentation to market in a speculative manner (i.e. a type of housing package), the construction project due to its nature remains reactive to the needs of the client (Thomson 2006).This changes the dynamics of our understanding behind the concept of product and makes it a difficult term to use when referring to the *end product* of the construction project. In addition to this difficulty, the uniqueness of each project must be considered. Although they are unique they do not necessarily represent an innovation either during production or in its end state.

Barrett and Sexton (2006) discuss the context of innovation in two schools of thought on what drives innovation: the 'market-based' view of innovation and the 'resource-based' view of innovation. They argue that construction innovation actively is stimulated by changing in clients need and unpredictable project-specific conditions. Depending on the mode of external environment whether it is enabling or constraining the client relationship become either value-oriented or cost-oriented.

The Process of innovation could be broadly categorised as rational school and behavioural school. The rational school of innovation considers innovation as a linear process, which has been widely criticized for not considering the dynamic environment and uncertainties within the project environment (Barrett and Sexton 2006). The behavioural school of thought couples the innovation process with the ambiguities and uncertainties of organisational reality. The process of innovation in project-based firms is described as mainly behavioural. This illustrates the gap between current performance and the desired performance of a construction firm as a dynamic process with peaks and troughs over the time which represents the innovation as 'action' and resistance to innovation 'reaction' (Barrett and Sexton 2006). A successful innovation happens when action forces the reactions. Taking into account these arguments, the scholars have mostly focused on the operational format approach and failed to employ any strategic management approach.

COMPETITIVE ADVANTAGE APPROACHES

As mentioned, despite the fact that innovation has been recognised as a source of competitive advantage (Ozorhon et al. 2010), historically the construction industry has been recognised for low innovation levels. Furthermore construction has been criticised for its inability to adjust itself to the ever-changing of modern business environment through its identification as a negative influence on wider problems such as productivity and quality (Nam and Tatum 1997, Thomson 2006, Rose and Manley 2011, Egan 1998, Fairclough 2002). In the past few decades competitive advantage has been in the centre of strategic thinking. In the other word, companies need some advantage over the competition in order to sustain itself in marketplace. Competitive advantage motivates the organisation to explore new philosophies to over their competitors (Dulaimi 2008). Porter (1998) describes competitive advantage as the added-value that a firm is able to create for a buyer which exceeds the cost of creating it. He also explains the route to competitive advantage is 'strategy' formed from unique insides of organisation into industry relationships. Dulaimi (2008) describes examples of business development agenda of some organisation including quality assurance, total quality management and lean thinking and argues that such new ideas in most cases has allowed companies to achieve only incremental improvement to the

existing practice. However, in a very 'crowded market' the organisation success cannot longer sustainable unless with a sustainable innovation strategy which continuously creates and exploits new markets rather than competing in existing markets (Dulaimi 2008). The innovation strategy provides a gap for the competitors and increases the value for customers. To remain successful such firms need to rapidly exploit newly discovered markets before competitors catch up (Dulaimi 2008).

STRATEGIC MANAGEMENT APPROACH AND MOTIVATION FOR INNOVATION

The term strategy has its root in the military and has existed for centuries. The realisation of strategy as an academic discipline and distinct business sense which first arose in America is far younger. Johnson et al. (2008) define strategy "as the direction and scope of an organisation over the long term, which achieves advantage in a changing environment through its configuration of resources and competences with the aim of fulfilling stakeholder expectations". Porter (1996) states that "If there were only one ideal position there would be no need for strategy". Individual imagination and creativity plays a main role in strategy activities as well as highly motivating especially when connected to practical outcomes and reward structures (Stewart and Fenn 2006). However, low presence of strategy as the foundation of innovation in the construction industry is noticed. It can be argued that this is due to the attitude of the industry (Cheah and Chew 2005). Innovation without strategy-oriented either is blind or will never happen and no goal to exploit the ideas in pursuit of. In general, without strategy there is no motivation for innovation. Stewart and Fenn (2006) state that "A strategic perspective on innovation and strategic thinking will motivate the organisation to look beyond the product and the process to the entire system for delivering value to the customer". Strategy activity requires strategic thinking which is 'a process of identifying, diagnosing, convincing and realising solutions to problems regarding the organisation using a balance of rational analysis and generative creativity' (Whittington et al. 2003). Stewart and Fenn (2006) highlight that seeing how things 'might be' different is the inception of strategic thinking. At the meantime, construction managers need to recognise the feasibility with the pragmatism and the products of strategy discourse.

Despite many efforts on strategies driven by competition the firms fail to innovate and choose imitation over innovation or achieve no more than incremental innovation. In contrast, 'value innovation' pushes manager to go beyond the incremental improvement to totally 'new way of doing things' and highlights equal on value and innovation.

According to Brochner (2008), there is a general belief that clients are the only participants in construction who have the ability to take an overview across the inception and process of innovation and encourage all the actors in the process. However, Tzortzopoulos et al. (2008) argue that most of clients in construction have a desire to avoid innovation because of the associated risk with it. If clients do not see the benefits from innovation they would have no reason to support them. Sir John Egan states that clients in the construction industry are not educated and have the habit of interest in low-cost rather than value. Their procurement approach provides less opportunity for contractors to add value through innovation; and to enable this down the supply chain. Winch (2008) argues that the effective creation of value in construction is the alignment of incentives to all the players involved in construction

process not only one group of players. He also mentions that the understanding of constructed product as an asset is important. Seeing construction products as an assets rather than artefact should be developed. In addition, clients need a strategic overview on their goals to understand the benefits of innovations made by contractors. They could provide incentives to other players to innovate by choosing appropriate procurement methods (Widen et al. 2008).

CONCLUSIONS

The problem with innovation management in the construction industry is a longstanding one. The main focus of this paper has been to broaden the understanding of innovation with the construction industry in both project and organisational context. The literature reviewed highlighted that the management of innovation in construction project is very complicated and the characteristics of the construction industry create problems for the speed of integration of new ideas. In order to understand innovation management in the construction industry, distinguishing project innovation and organisational innovation is essential. This far, scholars have mainly focused on the theoretical level of construction innovation and failed to assess the practical view of innovation within construction environment. It could be concluded that most of the literature focused on R&D and product innovation obtained from manufacturing production and failed to observe the innovation context within construction environment. Through this critical review, it is noted that there is very little appreciation on strategic management approach on construction innovation and no incentives provided for players to innovate. Clients as a main potential driver of innovation in the construction industry play a crucial role to motivate other players. This can be achieved by providing appropriate procurement methods. Clients need to provide incentives for innovation by strategic overview of goals of a project.

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A Taxonomy For The Impact And Management Of Variation Orders In Construction Projects

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Abstract:
Variation orders usually negatively affect the progress of construction projects, to the detriment of their objectives. They typically involve dealing with additional work that was not anticipated at the time the contract for a project was signed, which generally leads to delays, cost overruns, quality defects and even disputes and conflicts among the different parties involved in the construction project. A review of the literature is conducted to develop a taxonomy on the impact and management of variation orders in construction projects. The paper therefore attempts to introduce the taxonomy as a theoretical framework. This framework will support the theory of this research, with the purpose of more effectively managing variation orders in the construction industry.

Keywords:
Construction project; management of variations; taxonomy of variation orders; variation orders.

1 Introduction

The construction industry has been described as complicated and uncertain in nature, as each construction project has its own unique circumstances and conditions. The complexity of construction projects means that it is almost impossible to deliver a project without any change in its lifecycle; that is, every construction project is unique in many respects, but liability to change is an attribute that generally characterises almost all projects. This has led Revay (2002) to claim that change is *a fact of life* for a construction project. Baxendale and Schofield (1986) define variation orders as any change that can occur to the basis of the project that differs from the agreed and signed contract. Following the same line of thought, Ssegawa, et al. (2002) explain that sources that might trigger change in a construction project can be as simple as a change of mind on the part of the clients, or their consultant, or unforeseen problems raised by the main contractor or sub-contractors.

This paper intends to highlight the impact and management of variation orders in construction projects by reviewing the existing literature in relation to this. The first section of the paper addresses the types and causes of variation orders. Following this, the paper attempts to review the developed methods and models to manage variation

orders. Then, an approach will be made to analyse and categorise the literature to develop a taxonomy of variation orders with regards to impact and management.

2 Research Problem

Variation orders affect the progress of any construction project and will have an influence on the achievement of its objectives. Variation orders typically involve dealing with additional work not anticipated when the original contract was signed, leading to delays, cost overruns, quality defects and even disputes and conflicts among the different parties involved in a construction project (Baxendale and Schofield, 1986). Therefore, a better understanding of the literature review needs to be introduced into the construction industry in order to clarify the negative impact of variation orders. Furthermore, this study attempts to achieve more effective management of variation orders by developing a taxonomy of the variation order literature review.

3 Research Aim

The proposed paper will draw a map and develop a taxonomy for variation order literature worldwide in terms of the impact of variation orders and managing them to introduce a theoretical framework. This framework will support the theory of the proposed research and assist the researcher to produce a solid base for managing variation orders in construction projects. Moreover, the developed taxonomy will assist in gaining a better understanding and increase the efficiency of dealing effectively with variation orders in construction projects. Additionally, project teams can use this taxonomy to ensure all the key factors related to variation orders are covered, in order to manage them more easily.

4 Literature Review

4.1 Possible Impact of Variation Orders

The possible impact of variation orders is well-documented in the literature (CII, 1986; CII, 1990; Clough and Sears, 1994; CII, 1994; Thomas and Napolitan, 1995; Fisk, 1997; Ibbs *et al.,* 1998; Arain and Pheng, 2005). However, according to Arain and Pheng (2005a), the most commonly acknowledged impact is often referred to in terms of 16 aspects. These are:

4.1.1 Impact on progress

One of the most cited impacts of variation orders is that affecting the overall progress of the project (for example, CII, 1994; Assaf and Al-Hejji, 2006). Put another way, variation orders often result in delay and, in business, time is always the equivalent of money. However, the effect discussed here may vary depending on the time delay the variation order might cause and, subsequently, the amount of money needed to complete the project.

4.1.2 Cost

Another commonly addressed element that might demonstrate the potential impact of a variation order on a project is that of cost. A change in one of the project elements, for example, design, might result in a change in cost. This is why a contingency sum is often maintained, in order to allow for any possible variations in the project. This was supported by Clough and Sears (1994) and Assaf and Al-Hejji (2006).

4.1.3 Employment of new professionals

Although the frequency of variation orders differs from project to project, they are often described as "frequent" in complex technological projects (CII, 1995) where there is a need for experts and professionals, whose expertise is considered a fundamental requirement for such complex projects (Fisk, 1997). Hence, hiring new experts or replacing existing teams might arise as essential requirements for a project and this would involve a variety of impacts on the progression of the project.

4.1.4 Increase in overhead expenses

Implementation of any variation orders requires, as O'Brien (1998) describes, processing procedures, paperwork and reviews before they can even begin to be implemented, which would generally result in an increase in overhead expenses for the stakeholders. This where the contingency fund mentioned earlier comes to the fore.

4.1.5 Delay in payment

Another related element is delay in payment which, if such a delay occurs frequently enough (CII, 1990), often results in preventing progress in the project, leading to impediments in achieving the targeted milestones during construction (CII, 1995) and timely payment to contractors. Additionally, there is also the possibility of serious problems where subcontractors are not paid due to the delay in the contractors' payment.

4.1.6 Quality degradation

High frequency of variation orders might have an impact on the quality of work (Fisk, 1997). To CII (1995), the quality of work was generally poor due when there were frequent variations as contractors tended to compensate for the losses by cutting corners.

4.1.7 Productivity degradation

Variation orders have a direct relationship with individual and group productivity, especially in cases of lack of materials and information, as well as the work being out of sequence. Frequent interruptions, delays and redirection of work are often associated with psychological aspects that could easily de-motivate personnel at all levels. Accordingly, productivity is questioned, as Ibbs (1997a) describes, as a negative association between variation orders and productivity can be translated into labour cost or dollar value. In this respect, Thomas and Napolitan (1995) concluded that variations normally led to disruptions and these disruptions were responsible for labour productivity degradation. Hester *et al*. (1991) suggest that productivity is often influenced because individuals have to endure longer working hours, work overload and

prolonged periods of compensating for schedule delays. Management of variation therefore requires management of disruptions, though disruptive effects might be inevitable.

4.1.8 Procurement delay

Hester *et al*. (1991) observed that procurement delays were common effects of variations in relation to new resources for construction projects. O'Brien (1998) explains that variation orders that occur when construction is on-going may require revised procurement requests. Procurement delays can be frequent due to variations that require new materials and specialised equipment.

4.1.9 Rework and demolition

While variations required while construction is in progress, or even completed, can lead to delays in project completion (CII, 1990), it is not uncommon to encounter rework and demolition as a result of variations in construction projects (Clough and Sears, 1994). The knocking down and rework of certain areas might be predictable due to variations during the construction phase but they can also happen even after project completion.

4.1.10 Logistics delays

Fisk (1997) explains that, when variations are made on the basis of the need for new materials, tools and equipment, it is not uncommon to expect logistics delays. Similarly, Hester *et al*. (1991) observed that logistics delays were a significant outcome arising from variations in construction projects.

4.1.11 Damage to firms' reputations

While variations can be described as a major starting point for construction claims and disputes (Fisk, 1997; Kumaraswamy *et al*., 1998), it can be anticipated that such claims and disputes would affect firms' reputations, which might, in turn, result in insolvency in severe cases. In fact, variations can result in endless and serious disputes between the different groups of stakeholders.

4.1.12 Poor safety conditions

Safety conditions within any given project can be affected by variations (O'Brien, 1998; Arain *et al*., 2004) as changes in construction method(s), materials and equipment might necessitate additional safety measures during the construction process.

4.1.13 Poor professional relationships

As mentioned previously, disputes are often triggered by variations (Fisk, 1997), which can create a tense atmosphere between different groups of stakeholders. This is why the procedures presented in the contract and the fair allotment of risks can be helpful in putting an end to disputes through finding the middle ground, rather than initiating a court case (CII, 1986; Arain *et al*., 2004).

4.1.14 Additional payments for contractor(s)

Unsurprisingly, any additional payments for a contractor(s) involved in a project could increase the potential impact of variations in construction projects. This is why the

contractor often anticipates variations as they frequently entail extra payments. Variations are therefore seen to be a customary source of extra work for the contractor (O'Brien, 1998).

4.1.15 Disputes among professionals

Similar to poor professional relationships, the potential for disputes between the different groups of stakeholders formulates possible effects of frequent variations in construction projects. Though such disputes over variation orders and claims are often expected, and might even become inevitable (CII, 1986), procedures presented in the contract and the fair allotment of risks can be beneficial in relation to putting an end to disputes through finding the middle ground, rather than initiating a court case (CII, 1986; Arain *et al*., 2004).

4.1.16 Completion schedule delay

Completion schedule delays can also be considered to be a direct result of variations in construction projects (Ibbs, 1997b). Zeitoun and Oberlender (1993) reported that 9% of the original schedule for the 71 fixed price projects studied were due to variation orders. Likewise, Kumaraswamy *et al*. (1998) examined claims for time extensions due to excusable delays in Hong Kong's civil engineering projects and their findings claimed 50% of the delayed projects resulted from variations.

4.2 Types of Variation Orders

The concept of variation orders has become well established in the literature and a number of typologies have been developed. Cox (1997) put forward a trichotomy that describes types of change. According to Cox (1997), this includes:

a) a formal change order: this is an actual document called a *change order*, which might be issued by a client and might result in modifying the contract terms, plans or specifications;

b) a productive change order: this is extra contract work performed pursuant either to oral or implied owner directives, or as a result of problems for which the owner is responsible; and

c) a principal change order: this may occur whenever there is a considerable amount of work required outside the scope of the original contract.

Similarly, Ndihokubwayo (2008) cites Arain and Pheng (2005b), who categorise these variation orders as *beneficial* and *detrimental*. According to Arain and Pheng (2005b), a beneficial variation order is one delivered to better the quality standard or trim down the cost, timetable or degree of difficulty in a project.

On the other hand, detrimental variation orders, explains Ndihokubwayo (2008), represent the negative side. Here, Ndihokubwayo (2008) cites Arain and Pheng's (2005b) description of a detrimental variation order as "one that negatively impacts the client's value or project performance". Put another way, a client who is experiencing financial problems may require the substitution of quality, standard, expensive materials to substandard cheap materials.

In a similar manner, Motawa et al., (2007) classify the types of variation orders as a "*gradual change*" or a "*radical change*", based on the level of severity, or an "*anticipated change*" or an "*emergent change*", based on whether it is intended or not.

4.3 Causes of Variation Orders

While reviewing the literature indicates that different stakeholders (for example, the client, architect, contractor etc.) might be direct causes of variations, it also implies that variations can be initiated for different reasons, be they design-based, financial, aesthetic, changes in drawings, weather, geological or geotechnical reasons (Ssegawa, et al., 2002 and Turner, 1984). However, Arain (2005) classifies the causes of variations into five categories. These are:

1. *owner-related variations (ORV),*
2. *consultant-related variations (CRV),*
3. *contractor-related variations (CTRV),*
4. *other variations (OV), and*
5. *combinations of causes (CC)*

Following a similar line of thought, Enshassi, et al. (2010) provide a list of the top ten most common initiators of variation within the construction industry. These are: "*lack of materials and equipment, change in design by consultant, lack of consultant's knowledge of available materials, errors and omission in design, conflicts between contract documents, owner's financial problems, lack of coordination among project parties, using inadequate specification for local markets by international consultant, internal politics, and change in specification by owners"*

Correspondingly, Alnuaimi, et al. (2010) and Oladapo (2007) state that client requested additional works and modifications to the design are the main causes of changes in construction projects. Furthermore, Motawa (2005) noted that *"design errors, change in the functional requirements of the project and unforeseen conditions"* are the most important factors in the occurrence of variation orders.

4.4 Management of Variation Orders

Due to the inevitability of variation orders, as well as their potential impact on the planning, design, progress and completion of any given construction project, it is not uncommon for the literature (for example, Arain and Pheng, 2005; Krone, 1991) to devote considerable effort and time to the experimentation and theorisation of how such orders can best be managed. In this respect, Arain and Pheng (2005) assert, "*The issue of managing variations has received much attention in the literature. Despite many articles and much discussion in practice and in the academic literature, the issue of learning from past projects in making timely and more informed decisions for the effective management of variation orders has not been explored much in the literature*".

In fact, several strategies have been acknowledged as useful in managing variation orders. According to Charoenngam, et al. (2003), among the various strategies used to manage variations is that of involving the creation of good communication and

cooperation between project team members. Charoenngam, et al. (2003) further explain that, in making information accessible to all stakeholders, it is important to establish such communication and cooperation and that is why the authors advise making good use of Internet technology as the communication media, where accessibility to timely and accurate information is not bound to a time and place. While Jacob (1978, p.64-65) noted that *"lax attitudes and unfamiliarity with proper change order procedures have led to serious financial loss and insolvency",* Chan and Yeong (1995) assert that good contract documentation and good communication and cooperation between building team members are major elements that can make the task of managing change orders easier. As for good documentation, explain Chan and Yeong (1995), it is generally facilitated by designing an efficient change order system, geared towards understanding the change order process or "*workflow"*, which can be collected from the standard forms of contract. With regards to good communication, however, it might be facilitated by providing information using a well-timed procedure.

In a similar manner, Krone (1991) suggests *a variation order process,* in which efficient administrative processing is promoted. Krone's (1991) attempt claims to address the day-by-day demands of changes in the construction process. Here, the contractual analysis technique (CAT) suggests that the initial announcement and submission of proposals helps to maintain management control and avoid impact claims. Although CAT paved the way for future contract variation clauses in construction management, such a proposed process was bound to administrative processing and addressing the day-to-day demands of variations in the construction process. On the other hand, functional analysis concept design (FACD) was another methodology offered to reduce the number of variation orders in construction projects (Stocks and Singh, 1999). To these authors, FACD was a practical method that could reduce construction costs overall. Following a similar line of thought, Harrington, et al. (2000) introduced the management of change in the organisational context (MOC). This is a theoretical model, which includes a structured process consisting of seven phases. These phases are:

(1) clarify the project;

(2) announce the project;

(3) conduct the diagnosis;

(4) develop an implementation plan;

(5) execute the plan;

(6) monitor progress and problems; and

(7) evaluate the final results.

According to Harrington, et al. (2000), MOC or, rather, its structure can be applied outside the organisation to any project change management. Gray and Hughes (2001) proposed another strand of controlling and managing variations, where their theoretical model had the central idea of *"recognize, evaluate, resolve and implement variations in a structured and effective way".*

Similarly, the Construction Industry Institute (1994b) and Ibbs, et al. (2001) introduced the change management system (CMS), which is a two-level process model, with principles as its foundation and management processes to implement those principles. The model was based on five main principles, which can be summarised as:

(1) Promote a balanced change culture;

(2) Recognise change;

(3) Evaluate change;

(4) Implement change; and

(5) Improve from lessons learned.

However, CMS was subject to much criticism on the basis that it lacked the basic principles and processes for implementing controls for future variations in construction projects. However, most of these models have their pros and cons and while one of them might be suitable for one project, it might not be practical enough for another. Nevertheless, it can be claimed here, as well as elsewhere (Charoenngam, et al*.,* 2003), that success in managing change orders results in uninterrupted construction operations and an agreed final project cost, as well as duration.

5 Taxonomy of Variation Orders

Generally speaking, a taxonomy is identified as a *"process or a system of organizing things into different groups that show natural relationships"* (Longman Dictionary, 2007). Theoretically, the development of a taxonomy takes into consideration the importance of separating components within groups. Here Sun and Meng (2008) carried out a study into the taxonomy for change causes and effects in the construction industry, to fill a knowledge gap, by: (1) reviewing the existing literature on project change causes and effects; (2) developing two taxonomies for change causes and effects and (3) showing how taxonomies can be used.

At that time of the abovementioned study, 101 papers were found on variation orders in the construction industry. These publications covered most of the research areas worldwide. Sun and Meng (2008) categorised variation order papers in terms of paper source, published year, country of the study and research method. Subsequently, these papers were categorised into three groups, as follows: (1) papers addressing change causes, (2) papers addressing the impact of the changes (3) and papers addressing both causes and impacts of changes.

Moving to this study, which follows a different perspective and criteria from the aforementioned study, the proposed research focuses on variation orders in the construction industry from a higher perspective with regards to impact and management levels, rather than causes and impact levels. To achieve that, a preliminary review found numerous papers on the proposed research area. The majority of these papers fall into two main groups, which are group (A), which deals with the causes and impact of variation orders and group (B), about managing variation orders. Both groups have been divided into three categories in terms of the research purpose, the methodology and the results of these studies.

Firstly, in group (A), the most common purpose of these papers, which deal with the influences of variation orders in the construction industry, is to determine the types and

causes of variation orders. The majority of these studies deal with particular construction projects and countries, such as the research by Alnuaimi, et al. (2010), Oladapo (2007), Ndihokubwayo (2008), Moselhi, et al. (2005), Ssegawa, et al. (2002) and Arain and Pheng (2005a).
The methodologies used in most of the aforementioned papers in group (A) were questionnaires, interviews and case studies, where the researchers wished to determine the impact, types and causes of variation orders, in particular, across a small number of construction projects. The results of these studies proved that variation orders have a negative significant impact on the project progress and performance in terms of time, cost and quality. Moreover, in some cases, variations led to disputes and conflicts between the project parties.

Secondly, in group (B), researchers, such as Motawa, et al. (2007), Arain and Pheng (2005; 2007), Hassanein and El Nemr (2007), Hao, et al. (2008), Senaratne and Sexton (2009), Arain (2005), Motawa (2005) and Charoenngam, et al. (2003), aim to manage variation orders in order to minimise the frequency of change orders and to avoid the problems associated with them. In addition, they sought to speed up the processes of obtaining a change order to save time and money.

In order to achieve these objectives researchers attempted to create a database, develop a model or implement a change order management system (COMS) to deal with a large number of construction projects and to manage variation orders effectively. However, these methods require the comprehensiveness and quality of the project records (Sun and Meng, 2008). The results of the research indicate that good communication, co-operation among the project teams, good contract documentation and learning from similar past construction projects will assist in reducing the frequency of detrimental change orders. Table 1 shows a summary of the taxonomy of variation orders in terms of impact and management.

Table 1. A summary of the taxonomy of variation orders

Type of study	Purpose	Methodology	Results
Group (A): Impact of variation orders	1-Types of variations e.g. (Arain and Pheng, 2005a) 2- Causes of variations e.g. (Oladapo, 2007)	1-Questionnaire (Alnuaimi, et al., 2010) 2- Interview (Hassanein and El Nemr, 2010) 3- Case study (Oladapo, 2007)	Variation orders have a negative significant impact on the project progress (Alnuaimi, et al., 2010; Oladapo, 2007)
Group (B): Managing variation orders	1-Speed up the process (Arain and Pheng, 2007) 2- Minimise variations (Arain and Pheng, 2005) 3- Avoid problems (Hassanein and El Nemr, 2010)	1- Creating a database (Charoenngam, et al., 2003) 2- Developing a model (Motawa, 2005) 3- Implementing COMS (Motawa, et al., 2007)	1- Good communication (Arain and Pheng, 2007) 2- Cooperation (Charoenngam, et al., 2003) 3- Good contract (Hao, et al., 2008) 4- Learning from past projects (Arain and Pheng, 2005)

The proposed taxonomy can be implemented in different construction projects and used as a framework by project teams to ensure all key factors related to variation orders are covered. In addition, this taxonomy can assist the project team in dealing with managing variation orders efficiently by having good communication skills, good co-operation among the project parties and well-written contract documentation. Additionally, reviewing and evaluating the most common causes and types of variation orders from past similar construction projects will help the project members to deal with variations.

6 Conclusion

Variation orders are an important component of the construction industry, which can simply be described here as a change, whether radical or reasonable, in the quantity or quality of the work agreed to in a contract, as shown in the drawings or described in the specification, listed on a schedule. It can also be a change in the time allowed for completion and this why the consequences of such changes often entail various impacts on the budget. Due to their importance and inevitability, variation orders, as integral components of the industry, are therefore considered as one of the main influential factors in the failure to deliver a construction project successfully. In fact, in some cases, variation orders can be beneficial, providing better quality standards, saving time and reducing costs as well. However, since most variation orders have a negative significant impact on construction projects, leading to time delays and cost overruns, various researchers have shown interest in examining the most effective way(s) to manage variation orders. As this research is based on the existing literature review it has led to establishing a taxonomy for the impact and management of variation orders in construction projects to be implemented in the construction industry in the future. The proposed taxonomy provides an analysis of variation order impact and management literature to help project teams to minimise the occurrence of variation orders and, moreover, to assist to deal with managing them effectively by reviewing and evaluating the most common negative impacts of variation orders.

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A Taxonomy of the Legal and Contractual Issues Related to Building Information Modelling Integration

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Abstract:
Despite the promise of Building Information Modelling (BIM) providing increased scope for inter-project participant collaboration the reality has thus far been disappointing. Whilst issues of interoperability (technological compatibility) are partially responsible for this it is also frequently observed that existing conventional building contracts act as barriers to ICT-mediated collaboration: BIM is particularly sensitive to the legal environment within it is being deployed for the success or otherwise of attempts at collaboration. Yet it remains likely that the various permutations of procurement and standard forms of contract will be likely to be continued to be used into the foreseeable future. It is therefore desirable to identify and understand the ways in which conventional contract conditions have the potential to prove inappropriate or counterproductive in a BIM-enabled project environment. This paper presents a taxonomy of the legal and contractual issues related to BIM integration, which provides a suitable basis for future application to the analysis of specific standard forms of construction contract.

Keywords:
BIM, business barriers, contracts, legal barriers

1 Introduction

The Architectural Engineering Construction and Facilities Management (AECFM) industry is commonly characterised as being fragmented, frequently stricken by crisis and conflict, with high levels of client disappointment and dissatisfaction (Sexton and Barrett, 2003). Numerous Royal Commissions, investigations and industry round tables have concurred with this negative assessment and have gone on to produce an array of recommendations. Two suggestions emanating from Egan's (1998) report into the industry recommended the encouragement of collaborative project teams using emerging Information and Communication Technologies; specifically computer

modelling of the end product to minimise problems during construction and checking for conformance to customer expectations.

Building Information Modelling (BIM) has emerged as the computer-based assessment that Egan flagged. This has been defined as an:

> *"IT enabled approach that involves applying and maintaining an integrated digital representation of building information for different phases of the project lifecycle in the form of a data repository"(Gu and London, 2010 p. 988)*

BIM goes beyond the simple parameters set by Egan of conformance checking and minimisation of construction problems, to include visualisation of design code checking, quantity take-off and cost planning, facilities maintenance and services clash detection (Eastman, Teicholz, Sacks and Liston, 2011). Ultimately the benefits of BIM adoption san be summarised as the overall reduction of project risks and the encouragement of collaboration between project team members (Kymmell, 2008).

In spite of the wide ranging benefits of BIM adoption and use technology uptake remains chiefly among design team members, with limited adoption by those downstream of the design phase (Sebastian, 2011). Research into laggard behaviour has focused on the barriers to BIM adoption including: justifying its uptake from a business perspective (Aranda-Mena, Crawford, Chevez and Froese, 2009); building a business case for its implementation (Gu and London, 2010); the interactions between the technology, users and other existing business systems and processes (Owen, Amor, Palmer, Dickinson, Tatum, Kazi, Prins, Kiviniemi and East, 2010).

Succar (2009) mapped the changes required for BIM implementation and developed three main categories: Technology , Policy and Process. Within the Policy step he identified two key areas requiring change: Contractual and Regulatory. McAdam (2010) built on these areas and identified several key themes of legal issues. This paper synthesises the items identified in Succar's (2009) "Policy" step and expands on the detailed Regulatory and Contractual issues identified by McAdam. This is achieved through a systematic meta-synthesis of literature associated with BIM Implementation.

2 BIM: Legal, Regulatory, Technical and Contractual Issues

A systematic literature review was undertaken, directed by the tenets of Succar's (2009) "Policy" process step and McAdam's (2010) detailed expansion of "Regulatory" and "Contractual" issues. Thereafter an inductive meta-synthesis (Walsh and Downe, 2005) was undertaken of these sources to reveal nine thematic areas: Intellectual Property and Security; Professional Liability; Standard Conditions of Contract / Contract Documents; Risk Allocation; Public Sector Capacity and Capability; Protocols and Processes; Procurement Policy and Processes; Legislation and Judicial Precedence, and; Compensation and Consideration. These are now explained in detail.

Generally, the legal and associated technical issues arise variously from the technology itself, how the technology is used within the project, or the procurement method

adopted (Ashcraft, 2008). To expand on the last of these, the polar extremes would be to use BIM in a traditional/construct-only procurement method, or in a collaborative environment using an integrated procurement method. Using BIM in either of these instances presents significant challenges for the legal, regulatory and procedural workflows associated with construction procurement.

2.1 Intellectual Property and Security

Determining Intellectual Property (IP) combined with maintaining data security is one of the most commonly identified legal issues associated with the use of BIM in a project setting. Adding to the complexity of IP and data security is the increasing use of BIM in a collaborative procurement environment such as an Integrated Project Delivery method. Haynes (2009 p3) frames the issue:

"What is more difficult in the BIM context is the fact that there may be numerous 'designers' creating models and various data bases and exchanging such models and information among various project participants, and even engaging in modification or alterations of such models through the creation of derivative models."

The issues associated with BIM IP and data security can be grouped under three subheadings: Ownership/Copyright of the Design; Ownership and Copyright of the Digital Model, and; Model and Information/Data Security. These are overarched by the twin matters of ease of data transfer, and increased formal and informal design collaboration between all project participants.

Determining how BIM affects the ownership and copyright of the facility design (including designs completed by contractors and subcontractors) has emerged as one of the major concerns of designers and legal commentators. Some of the specific issues encountered are how contracts address the issue of IP. This includes the mechanisms for tracking design changes, the jurisdiction of IP and finally ensuring all team members are conversant with the rules and regulations associated with the project The actual legislative requirements can be quite complex and can include international agreements as produced by the World Trade Organisation, Federal, State and local government acts and regulations.

Closely associated with the IP of the design is the ownership and copyright of the actual digital model. The model contains a wealth of information which can be valuable to the client, designer, contractor and subcontractors. Consequently, dependent upon contractual conditions, specific parties may not be allowed to use the information encapsulated in the model for future projects. Thus a selection of issues need to be considered, including the ownership of the model incorporating all derivative models, the final use of the model, if it will be used for facilities maintenance, tracking future modifications to the original, and the status of objects created by others that are incorporated in the model.

Ensuring the security of the model and confidentiality of the data contained within is the final sub-area. As project documents shift to file sharing websites or general access to project servers is provided, there are a number of concerns emerging related to data protection and security. This can include ensuring that the data is secure from outside

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access, manipulation and damage or unauthorised access by stakeholders within the project team itself. For example confidential information, trade secrets, patents and proprietary data requires protection. Further, if the project is commissioned by the Public Sector consideration of what information will become publically accessible after completion due to archiving and reporting requirements (Ashcraft, 2008).

2.2 Professional Liability

Professional Liability is another key area that has emerged from the implementation of BIM within procurement practices. There is a clear subdivision of liabilities relating to the creation and management of the design. For example, in the USA there is a clear divide between the liabilities associated design and that of construction, commonly referred to as the Spearin Doctrine. Other liability issues which have materialised are: the use of the model after construction; how much detail is inserted into the model by the designer and the standard of care with which it is introduced into the system; automated design by BIM authoring tools; establishing the entity responsible for managing the BIM; the contractual status of the model, and; changes required to insurance cover. Finally, the effects of collaborative methods in relation to liability is a key issue in BIM integration (Hurtado and O'connor, 2008; Larson and Golden, 2007).

2.3 Standard Conditions of Contract / Contract Documents

Currently there is a limited range of Standard Conditions of Contract which specifically reference or address the issues associated with BIM. Compounding the issue existing legislation and practices tend to favour printed two dimensional drawings and specifications. If a model is used as a contract document then its status as such needs to be clearly articulated with the actual contract. Lastly confirmation of any design changes need to be confirmed with all project stakeholders (Ashcraft, 2008; Olsen and Taylor, 2010).

2.4 Risk Allocation

Reflecting more generally on the ICT protocols required to manage a construction project, the items related to this category focus on the management of the technology such as hardware limitations, security concerns and change management issues (Wong and Lam, 2011).

2.5 Public Sector Agency Capacity and Capability

From the perspective of the public sector approving agencies there are two main legal issues which directly affect the ability assess and process digital models. The first is the requirement for the designer or other head consultant to lodge the design for approval and/or conformance checking (Allen, Becerik, Pollalis and Schwegler, 2005; Ashcraft, 2008). Secondly, there is usually a statutory requirement to submit the project design and specifications in a hardcopy format. These issues highlight extent to which legislators and the building approval regulations themselves have failed to accommodate the use of a digital model to convey design intent. More practically the approving and reviewing agencies do not have the knowledge or the capability to either process or assess digital models, nor have they developed specific standards for submitting models for assessment.

Stability of the design is the other key factor associated with Public Sector Agency (Ashcraft, 2008). One of the key benefits of BIM is the ability to accurately reproduce the proposed facility in a digital format. This accuracy goes against the current convention of the design professional in only producing enough information to convey design intent (Olsen and Taylor, 2010). It is this design intent which is submitted for authority approval. Further, the coordination of the various design disciplines and the detailed design development usually occur late in the project documentation process usually triggering a revision of the design. Any changes to the documentation tend not to form part of the approval process or submitted for revision of the design approval unless there is a significant departure from the original intent. Conflict and legal repercussions could occur if there is any discrepancy between the approved design, the construction model[s] and the actual construction onsite. Therefore Ashcraft (2008) notes the importance of defining what is needed for approvals and inspections, in addition to the acknowledgement within the legislative framework and agency ability to process a digital model for approval.

2.6 Protocols and Processes

The allocation of risk and consequent levels of reward to the most appropriate party to bear it is a major legal consideration. This consists of: the risk/reward for the initial designer/BIM modeller (Olsen and Taylor, 2010); risks associated with the software used to model; the effects of using a collaborative environment, and; types of insurance and responsibility for its acquisition.

2.7 Procurement Policy and Process

Allen et al (2005) note that public sector procurement law requires following a stringent set of policies and procedures that paradoxically reinforces the fragmented nature of the AECFM industry. Typically, the process uses a Traditional Design-Bid-Build procurement method, with little scope for collaboration. This reduces the advantages of using BIM, which is best suited to a collaborative environment. Moreover different procurement methods have different stakeholder risk profiles.

2.8 Legislation and Judicial Precedence

Legislation, or judicial precedence in the form of previous case law which is associated with the implementation and formation administration of e-business or e-construction is another major category. For example, a judicial precedent in America - the Spearin Doctrine - delineates the responsibility for errors in the design to the Architect and errors relating to means and methods of construction to the Contractor (Ashcraft, 2008) or the legislative requirements for forming a formal e-contract (Cooperative Research Centre for Construction Innovation, 2007).

2.9 Compensation and Consideration

The legal issues surrounding the topic of compensation and payments/consideration can be differentiated into two subcategories; the cost of implementing the technology and compensation/reward relating to its use by the project participants. Determining who pays for the implementation of the technology at both a project and business level is one of the most commonly issues associated with the legal barriers to BIM implementation.

For example the costs of training staff, purchasing of BIM software, upgrading of hardware, changes to workflows and the initial reduction in productivity whilst staff adapt to the new circumstances all have cost implications to a business and therefore require either a loss provision or some form of compensation. Thompson and Miner (2006) highlight the process for applying a standard practice risk assessment approach to implementing BIM in a business setting (Figure 1).

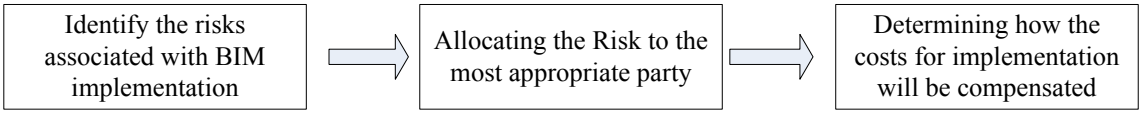

Figure 1. Determining Risk & Compensation

The second critical point relating to compensation and reward is how remuneration will be aligned with the changing risk profile of BIM use within a project procurement method. As noted previously the three traditional risk perspectives are associated with the client, designer and contractor. In a BIM enabled environment the designer is seen as taking much of the risk for little reward. This is related to the increased level of detailing BIM authoring tools are capable of which have previously been unachievable using conventional documentation methods. In essence the designer can now digitally document and coordinate a project to a high level of accuracy which goes beyond the traditional role of conveying design intent. Previously the builder was responsible for coordination and constructability, but clients are now expecting this task to be completed by the designer, prior to the commencement of construction. The effects of this are that the designer may not be paid for the extra effort or the additional risk it is assuming because of the increased level of design detail and coordination responsibilities. Further, there is also a lack of benefits to the designer for increasing the level of detail in a project, as they are realised later in the project. In the event a design & build or relational procurement method is used the underlying risk/reward conundrum still remains between the builder and the designer if a design consultant is engaged by the builder.

Another issue relating to remuneration is the change to traditional payment structures and sequencing when BIM is used in an integrated procurement delivery approach, and the additional costs such as insurance for data loss, new roles, and responsibilities associated with the project specifics. For example, due to the capacity and capability of BIM authoring tools the detailed design phase occurs earlier in the project design lifecycle. Both the designer and client need to be aware of the changing cash flow requirements. In addition, payment structures could be revised to incorporate key performance indicators linked to specific efficiency and productivity gains or value added by the model. Wheatly and Brown (2007) highlight the need for consideration of new roles and responsibilities within the project team (e.g. the model manager), requiring the control and management of project information that is unique to BIM-enabled projects. Other costs that require some form of compensation include the expenditure for data protection insurance and the costs incurred by subcontractors.

In summary: from a comprehensive review of the literature nine key areas associated with the legal and regulatory use and implementation of BIM, broadly corresponding to the tenets of Succar's (2009) "Policy" process step and McAdam's (2010) detailed expansion of "Regulatory" and "Contractual" issues were identified. These were subsequently given detail through a process of meta-synthesis, the specifics of which were explained in the previous sections.

3 Discussion

Research into the legal and business barriers associated with BIM is an emerging field within the AECFM industry. Industry based research associations and think tanks such as buildingSMART and the CIB have convened working parties to investigate and report on the issues, problems and enablers. The industry itself has published several new technical/process related BIM contract documents, management and implementation manuals such as the ConsensusDOCS and American Institute of Architects' BIM addendum and NATSPEC's Preliminary clauses. However these documents simply attach to the main contract with little or no attempt to address the changing risk allocation.

One of the emerging challenges facing the implementation of BIM is the lack of standard form contracts which specifically address the legal issues associated with the use of BIM (Lowe and Muncey, 2009). The reworking of contractual frameworks such as risk allocation and reward mechanisms, which allow for the inclusion of BIM processes, is an extremely complex process. The construction industry's reluctance to change and the current limited investigation into the relationships between legal implications and BIM use is making it even harder to achieve a consensus.

From a procurement systems perspective, discussion has focused on using a relational, or design and build system to achieve the full benefits of BIM, thereby overcoming many of the legal obstacles. As McAdam (2010) points out, there has been little empirical research into the law and procurement focusing on BIM in a contractual sense. This lack of empirical data, and the state of uncertainty in which the legal issues are understated or not fully understood, could be the next major impediment for BIM implementation with a collaborative procurement method. For example, Ashcraft (2008) notes there are little if any common law judgements clarifying the roles, responsibilities or legal standing relating to BIM.

Two developments within the industry that relate to BIM are the move towards relational procurement, and the increasing use of digital information as a contract document. One of the key functions of a contract is the allocation of risk to the different parties (Hughes and Greenwood, 1996). Ashcraft (2008) does not believe any new risks are created when using BIM in either a traditional or relational procurement system. The critical point is allocating the risk to the party most capable of managing/controlling the risk if it cannot be engineered out of the project. Moreover, when using a Design and Build system, making risk the responsibility of the contractor does not make the issue disappear: it is simply transferring the risk to another party. If the risk is not completely understood, an adverse outcome may be generated. Figure 2 highlights the four main standard procurement systems: Traditional, Design & Build

and Management approaches all have default risk allocations which have been developed over many years of trial and error, whereby relational approaches aim to manage risk as a collective or in a collaborative approach.

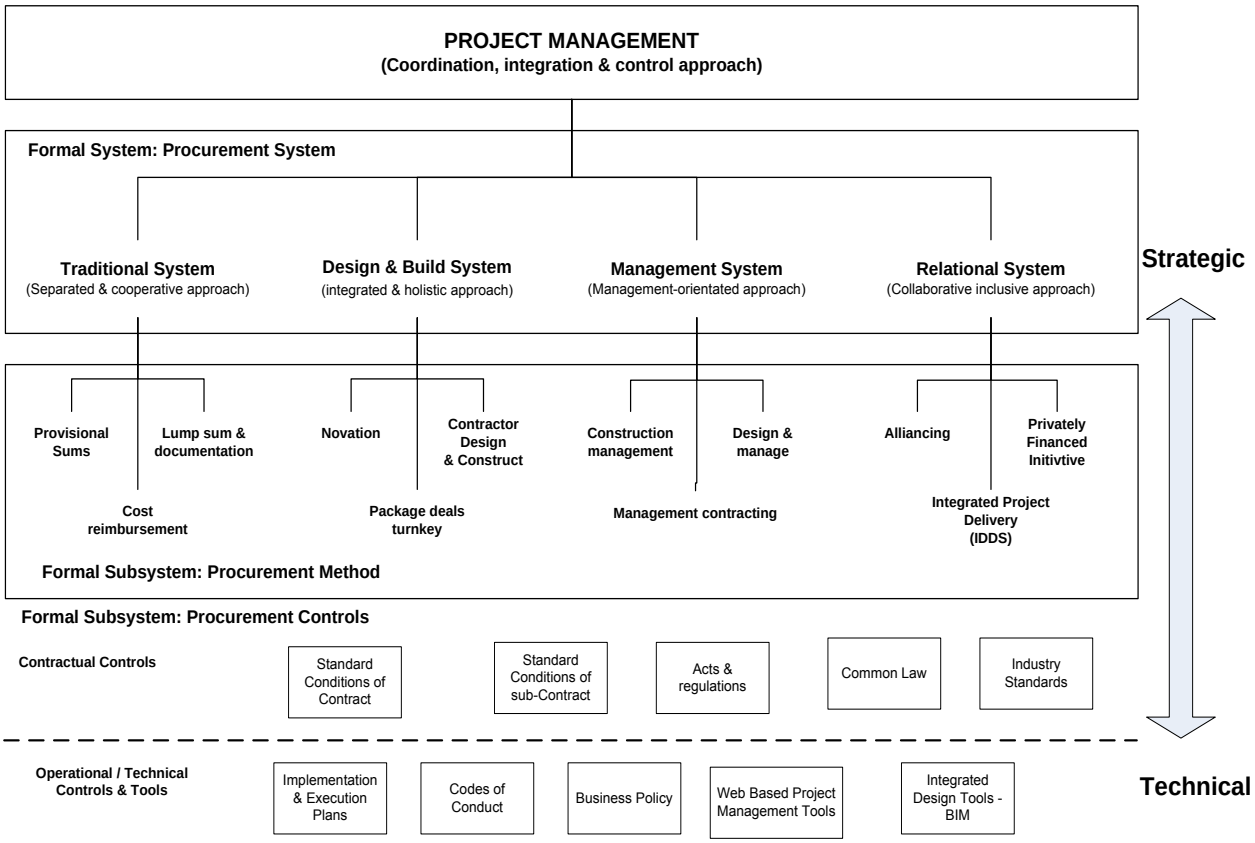

Figure 2 Categorisation of Procurement Systems (adapted from (Love, Skitmore and Earl, 1998)).

McAdam (2010) also discusses the chief legal risk when designers, contractors, subcontractors and suppliers collaborate as being the redirection of design responsibility to unsuspecting project participants and therefore the potential for them to acquire potentially crippling liability. This risk goes beyond Professional Liability and affects many of the other key legal areas. For example, using the taxonomy outlined in section 2 of this paper, Figure 3 maps an example of contractor design involvement and some of the potential outcomes (one of which is the addition of a tenth, interoperability domain). Early contractor design involvement or collaboration can affect the contractor's liability and risk profile. To ensure the changing liability is acknowledged and addressed appropriately, the risk allocation needs to be reflected in the conditions of contract. Further, the contractor will require contractor professional services insurance if it wishes to protect itself against any claims against design related errors. Moreover the client may well include the requirement for adequate professional indemnity insurance in the conditions of contract. An understanding of how prior judicial ruling protections are affected is also desirable. Finally, it is necessary to determine the extent that the contractor is entitled to additional compensation for early design involvement.

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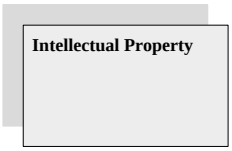

Figure 3 Cognitive model of the potential effects of contractor design input into BIM

From the perspective of the use of the BIM as a contract document, three main approaches have emerged (Ashcraft, 2008):

1. The BIM is a co-contract document but it is not submitted to any approval or permitting agencies,
2. The BIM is an inferential document that is used as a mechanism for visualisation of the design intent, and
3. The BIM is used as an accommodation document which can be used by the project participants but not wholly relied upon.

Whilst design liability in a collaborative environment, and the status of the BIM are considered to be crucial contemporary legal issues, others will continue emerge as the use and integration of BIM continues to evolve. Many of the low level technical and procedural legal issues have been addressed in contractual addenda and procedures manuals; however many other significant legal concerns still require further empirical investigation. In addition, as disputes over BIM reach litigation a whole new body of judicial precedence will provide a framework for BIM status and operation.

4 Conclusion

As the use of Building Information Modelling becomes more widespread within the AEC industry, the legal and associated technical issues identified will continue to pose problems and could hinder its integration into the procurement process. To summarise, the two main legal challenges are the shift from paper based drawings and specifications

forming the contract being superseded by digital models; in conjunction with a drive to embrace relationship/collaborative based procurement systems and methods. Specific contractual remedies are starting to emerge which address some of the technical issues, however the challenge is to remodel the procurement and business landscape which both supports the quantum legal shift in project and provides clarity and order to an otherwise chaotic design and construction process.

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Construction Law in Spanish buildings to improve their Sustainability

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Abstract:
Adaptation in Spain to recent European Union directives in the building sector enables the assessment of energy performance of buildings in order to improve their sustainability. Royal Decree 47/2007, of 19 January, specifically approves the basic procedure to certify energy performance in new buildings. Consequently, a scale is generated to ensure better energy rating and lower CO_2 emissions. This paper analyzes a pioneer study on a terraced family house in Spain. Construction features, especially the thermal envelope and the facilities of the building, which comply with new building regulations, and the climate zone where the building is located, are considered with a view to obtaining different energy performances. The private costs of these performances, including depreciation cost, facility management cost and energy consumption cost during the service life of the house, are analyzed. From this analysis, it can be concluded that the better energy performance is, the higher the private cost. A carbon tax equivalent to the social cost is, therefore, suggested as a means to promote better energy performance to, in turn, improve housing sustainability.

Keywords:
Carbon tax, construction law, energy performance in buildings, private cost, social cost

1 Introduction

Greenhouse gases (GHG) emissions caused by human activity contribute significantly to climate change. The third report of the International Panel on Climate Change indicates that global GHG emissions have increased significantly since the preindustrial era due to rising energy needs. In the construction sector, only buildings consume between 20% and 40% of energy in developed countries (Pérez-Lombard, et al. 2008),

and bearing in mind that much of the industry is related to building, this percentage could come close to the upper limit of 40% (Diakaki, et al. 2008). In the United States, figures reach up to 50% of buildings emissions (La Roche 2010). However, buildings are one of the elements that can reduce CO2 emissions more cost-effectively if compared with other emission-producing sectors.

Improving energy efficiency in buildings is considered a useful measure to decrease carbon emissions. In the European Union (EU), the Energy Performance of Building Directives[1] (EPBD) constitutes the regulatory framework to regulate the energy needs of buildings. According to these regulations, EU Member States must apply minimum requirements to rate the energy performance of buildings. European directives establish principles and basic requirements, and these regulations must be transposed by EU Member States to adapt them to their own particular conditions (Concerted Action, EPBD, 2008).

In Spain, the EPBD was partially transposed by means of three royal decrees:

- Royal Decree approving the Technical Building Code (Código Técnico de la Edificación, or CTE, in Spanish), approved by the Council of Ministers on 17th March 2006 and published in the Official Gazette on 28th March 2006. One of the 'basic documents' of the CTE, entitled CTE-HE, deals with energy saving. The requirements regarding energy performance in buildings in this document are in line with those set out in the EPBD in terms of energy saving and renewable energy systems. As of 17th September 2006, these requirements became mandatory for new buildings and buildings undergoing major renovations.

- Royal Decree on the Basic Procedure for Energy Performance Certification of new buildings, approved by the Council of Ministers on 17th January 2007, and published in the Official Gazette on 31st January 2007. Certification became compulsory for new buildings when applications for building permits were made after 31st October 2007.

- Royal Decree approving the review of the current 'Regulations for Thermal Installations in Buildings (RITE)', approved by the Council of Ministers on 20th July 2007 and published in the Official Gazette on 29th August 2007. RITE came into force on 1st March 2008.

The EPBD was partially transposed in Spain because the energy performance certification of existing buildings is not covered by the new decrees. Certification of existing buildings is still awaiting administrative approval.

This is a valuable tool to promote more energetically efficient buildings and, therefore, more sustainable ones.

[1] Directive 2002/91/EC of 16 December 2002 on the Energy Performance of Buildings.
Directive 2010/31/EU of 19 May 2010 on the Energy Performance of Buildings.

However besides these regulations, it is necessary to analyze the economic repercussion of such legislation in order to study the degree of implementation that can be reached by the most energetically efficient housing.

The main objective of this paper is to describe the existing legal procedure in Spain to certify the energy performance of new residential buildings and to study the economic viability of more efficient ratings.

2 Energy performance certification in residential buildings in Spain

Energy performance certification depends on three factors:

a. The building type. The energy certification methodology followed in Spain and Europe is based on the EPBD which distinguishes between residential houses and apartment buildings. Although apartment buildings are more common in Spain than houses (30% of residential dwellings are houses according to the Spanish 2001 national census) the study was made using houses because they are simpler to model for cost data and CO_2 emissions, and more importantly, because individual houses are less energy efficient and therefore incur greater social costs than apartment buildings. A recent study in the United Kingdom shows that the effects of the dwelling type on energy expenditure are significant, being flats more efficient than houses (Thanos and Dunse 2012).

b. The climatic zone of the building location and the 12 Spanish climatic zones, according to the CTE, have been included in this study. The CTE divides Spain into 12 climatic zones which are defined as the energy demand of buildings. Each provincial capital is assigned to a zone and the classification of the corresponding area reflects that of the provincial capital. However, within the same province different climatic zones may exist when altitudes vary by more than 200 meters from that of the provincial capital (Appendix D.1, CTE-HE1).

c. The thermal envelope of the building which is composed by all the enclosures that limited living spaces with the external environment (air or ground or another building) and all internal partitions that limit the habitable spaces with no habitable spaces which in turn are in contact with the external environment. The constructive section of the envelope is a key factor to consider, together with the design criteria, in order to reach high energy efficiency.

2.1 The case study building

The analyzed building is a terraced family house with a garage and utility installations in the basement and a ground and first floor for residential use. The surface area is 68.10 m^2 on the ground floor and is 58.88 m^2 on the first floor. It is located on the end of a terraced row and points 25 °N, and is considered to be the worst of the 13 houses forming the development from an energy efficiency point of view. This is due to the fact

that longer façade is exposed and it also presents a less favourable orientation. Figure 1 shows a section of the case study.

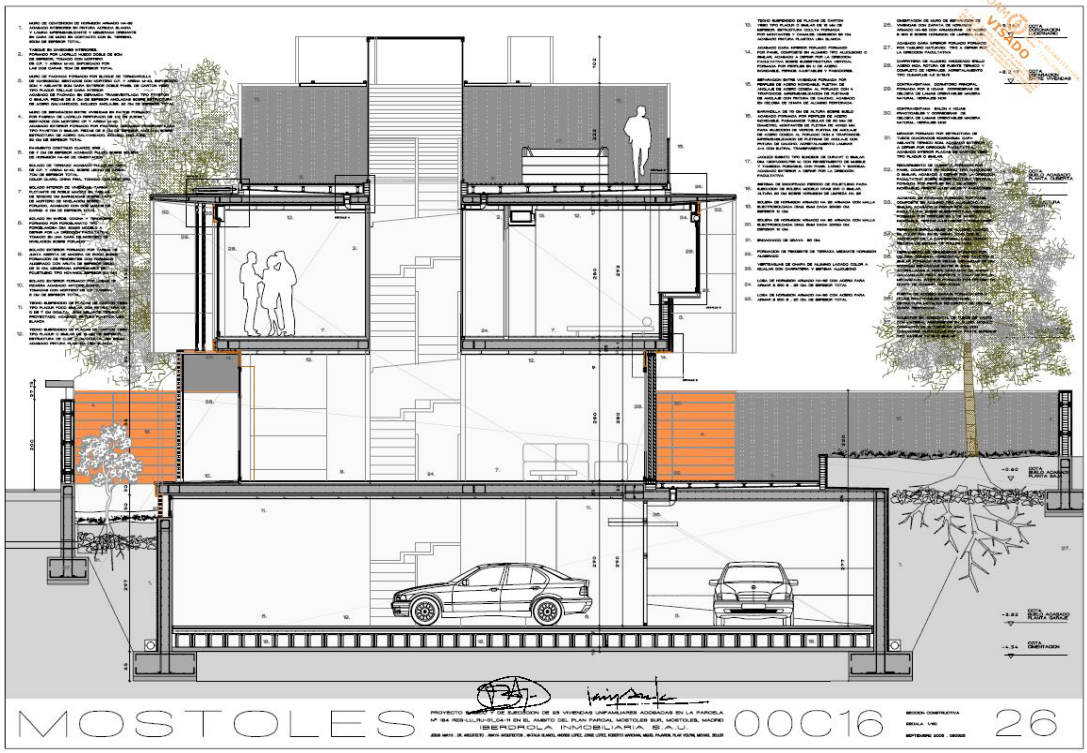

Figure 1. Section of the case study house

2.2 The climatic zones

According to the CTE, there are 12 climatic zones in Spain, which are defined according to the energy demand of the buildings. The system used to name the climatic zone is composed of a letter and a number indicating the severity of winters and summers, respectively. On the one hand, a letter A indicates mild winters and a letter E denotes the coldest winters. On the other hand, a number 1 indicates cool summers and a number 4 suggests the hottest summers. Consequently, the progression from climatic zone A to E indicates an increased need for heating, while the progression from climatic zone 1 to 4 suggests an increased need for cooling. A representative city has been selected for each climatic zone. The empty cells in Table 1 represent non existent combinations.

Table 1. Climatic zones and cities chosen to represent areas

COOLING	**HEATING**					
	Min					**Max**
		A	B	C	D	E
Min	1			C1 Santander	D1 Pamplona	E1 Burgos

	2			C2 Barcelona	D2 Logroño	
	3	A3 Málaga	B3 Castellón	C3 Granada	D3 Madrid	
Max	4	A4 Almería	B4 Seville	C4 Badajoz		

2.3 Regulations for the energy performance certification procedure

Procedures for rating the energy performance of residential buildings in Spain is detailed in the document *Energy rating scale. New buildings* (AICIA 2009). New buildings are assigned an energy rate on a scale of five values indicated by letters A to E, with A being the best rating. According to Royal Decree 47/2007, new buildings are assigned a label indicating their energy rate corresponding to this scale. These ratings are based on annual emission values in kg of CO_2 and on the annual primary energy consumption in kWh depending on: the type of building; the thermal envelope, the climatic zone; the municipality in which the building is located, and the minimum solar contribution to the domestic hot water (DHW) required in the municipality. Lower grades of F and G can be used in existing buildings, but new buildings that meet the technical building code must have an E grade or above.

According to the CTE, there are two options for certifying new buildings: simplified and general. The general option is required when certain physical characteristics of a building exceed given thresholds (over 60% of the façade contains openings and over 10% of the roof has skylights). The simplified option is used to check that the thermal envelope of the building (walls, roof, windows, etc.) does not exceed certain thermal transmittance limits (W/m^2K). This ensures a rating which will be E or D. There are several officially Ministry-approved methodologies to apply the simplified option (CE2, CES, CERMA, etc.).

However, higher energy performances (C, B, A) can be reached only with the general option. This consists in using two complementary programmes which are, to date, the only official option. The Lider program measures the adaptation of a project to the energy-saving part of CTE-HE-1. A building modeled in Lider can then be exported to the Calener-VYP program and energy rating is done after entering demands for heating, cooling, DHW and air-conditioning. Calener provides a label which indicates the energy performance of the simulated building, as shown in Figure 2.

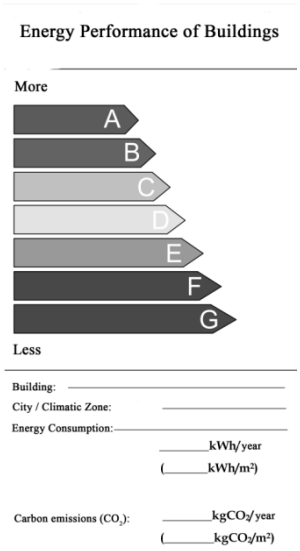

Figure 2. Energy efficiency label according to Royal Decree 47/07

3 Energy performance and building costs in a terraced-family house

3.1 Energy performance rating with Calener VYP

Initially, the constructive solutions of a building are the minimum requirements for the fulfilment of energy demands that the CTE specifies for the general option. Afterward, some solutions needed to reduce emissions are applied. These solutions have to do with the thermal envelope of the house and with its facilities. On the one hand, constructive solutions such as increasing the thickness of the insulation layers in the envelope, changing the materials of window profiles (aluminium, wood), the thickness of window panes, and so on, are used to improve energy performance. On the other hand, facilities also contribute to this improvement, which include heating, air-conditioning and DHW. Electricity is always used for cooling facilities, whereas heating and DHW facilities are simulated with different kinds of boilers and energy sources, such as electricity, natural gas or biomass, by taking into account the minimum input of solar energy for DHW according to the CTE. The combination of materials, constructive solutions and facilities allows various configurations to be obtained for each energy performance and climatic zone. There are 60 possible combinations resulting from the five energy performance grades (A-E) and the 12 climatic zones. Only 50 combinations are obtained because performance E was not reached at times after implementing the commercial format of constructive solutions, and because performance B could not be achieved on occasion with the materials and facilities used in this study.

3. 2 Private costs calculation

Once the configurations have been obtained, costs are obtained. These include the costs from the building site until the end of the service life of the house. They are considered private costs since they have to be paid by users. Private costs are the sum of three costs, these being:

- Depreciation cost: firstly, the investment cost is calculated by drawing up an estimation or budget with the chosen constructive solutions. Several solutions are used:

different insulation thicknesses, types of glass and window profiles, various heating or air-conditioning systems, etc. Moreover, prices are adapted to the Spanish province and to the total built-up area being considered. Prices have been adapted to the Spanish province by means of the Cype S.A. database for construction prices. To obtain the depreciation cost, it is necessary to estimate the service life of the different elements making up the building, which allows the cost per year to be estimated. The service life for the whole building is considered to be 100 years, as confirmed in various sources (Johnstone 2001a, 2001b; Rudbeck 2002; Davies and Wyatt 2004) and in valuation regulations[2]. This matches the observed ages of buildings from the Spanish building stock according to Spanish National Statistics Institute (INE) data. The service life for facilities and materials, which is shorter than that of the building considered as a whole, ranges from 10 to 25 years. Fifteen years is the time adopted for facilities, while 25 years is used for constructive elements such as tiles, kitchen utilities, and so forth. A linear depreciation is to be considered with a null residual value.

- Maintenance cost: this is calculated in accordance with different authors (Piper 1995; Brown 1996; Liska 2000; Kaiser 2001; Brathal and Langemo 2004) and prestigious institutions in the building sector, such as the Catalonian Technological Institute. The *Libro del Edificio* (Building Log Book) is also reviewed. This is a document drafted when a building is constructed and it contains, among other things, several aspects of the building management during its operational phase. There are certain regulations, which vary slightly from one province to another, that also deal with this aspect[3]. Measurements and prices for each task have also been considered, as has the periodicity with which they will occur during the service life of the building. Finally, 45 tasks were considered in terms of their periodicity in the total service life of the building.

- Energy consumption cost: three types of energy are considered for heating and hot water: electricity, natural gas, and biomass. Only electricity is used for cooling. The rates for electricity and gas are obtained from the Spanish official state gazette (BOE 31.12.09) and VAT was excluded. In the absence of official rates, biomass prices including delivery were obtained as market price averages from various suppliers.

Table 2. Private costs in €/m^2/year

Zone/Rating	A	B	C	D	E
A3	26.10	25.60	25.60	22.33	--
A4	27.44	26.55	26.55	22.38	--
B3	26.50	26.09	26.09	22.93	--
B4	27.51	26.30	26.30	23.55	23.16
C1	28.38	27.42	27.42	27.25	25.74
C2	29.20	27.22	27.22	26.69	25.77

[2] Order ECO 805/2003of 27 March on Valuation of Property and Financial Regulations (Article 19).

[3] Decree 35/01 of 9 March: it measures governing the use and maintenance of building on the Balearic Islands.
Decree 38/2004 of 2 July: regulations for the Building Book in La Rioja.
Decree 158/1997 of 8 July: regulations for the Building Book of existing housing and creating a program for the conservation of buildings in Catalonia.
Regional Decree 322/2000 of 2 October: Building Book regulations in Navarre.
Decree 14/02/02: it approves the Building Book in the Murcia Region.

C3	24.80	--	--	26.52	--
C4	24.12	--	--	23.55	--
D1	31.82	29.31	29.31	27.47	26.68
D2	30.54	28.57	28.57	28.47	26.94
D3	30.75	--	--	27.06	--
E1	29.62	27.61	27.61	26.63	--

From Table 2 it can be concluded that the better energy performance is, the higher the private costs. Therefore, by taking into account the three aforementioned costs and given the current conditions, better energy performance is not profitable. This means that it is unlikely that more sustainable dwellings are to be promoted if considering their energy efficiency.

On the other hand, better energy performances imply less CO_2 emissions. This could be used as an argument to promote better energy efficiency. The carbon emission cost can be considered an externality and it is difficult to value because there is no market for carbon emissions of residential buildings. This constitutes a social cost which can be internalized by means of an environmental tax so that users would be willing to improve the energy performance of their houses. Some north European countries have already used an environmental tax for CO_2 emissions. Finland, Norway, Denmark and Sweden set carbon taxes in 1990, 1991, 1992 and 1996, respectively. This solution seems to be successful according to different studies which confirm a drop in carbon emissions of 3% and 7% in Norway and Sweden, respectively, and a 10% fall in energy consumption in Denmark (Dresner and Ekins 2006).

From the values obtained for the 50 configurations, some mathematical models have been developed in accordance with the energy performance and climatic zone explanatory variables. Moreover, a model for CO_2 emissions, which considers the two aforementioned variables, was also carried out to obtain this social cost.

3.3 Private costs and CO_2 emissions models

CO_2 emissions and private costs components can be modeled by a multiple regression analysis by ordinary least squares in which the dependent variable (V) is expressed as follows:

$$V = a + b_1 X_1 + b_2 X_2 + \ldots\ldots + bn\, Xn + \varepsilon \qquad (1)$$

where:

a : constant term

bi : coefficients of the explanatory variables

Xi : explanatory variables

ε : random disturbance term

The variables used in the analysis are:

1. Dependent variables:

- C_{DEP}: Annual depreciation cost per square meter (€/m^2/year)
- C_{MAN}: Annual maintenance cost per square meter (€/m^2/year)
- C_{EN}: Annual energy consumption cost per square meter (€/m^2/year)
- KCO_2: Annual CO_2 emissions per square meter (kg CO_2/m^2/year)

2. Explanatory variables:
   - Energy performance defined by five dummy variables (A, B, C, D and E), one per energy rating
   - Climatic zone, quantified by the average annual temperature (T).

Table 3 shows the costs and CO_2 emissions models:

Table 3. Costs and carbon emissions models (significance:**0.01;* 0.05)

	Model 1	**Model 2**	**Model 3**	**Model 4**
	Dependent variables			
Explanatory variables	**C_{DEP}**	**C_{MAN}**	**C_{EN}**	**KCO_2**
T	0.082 (0.041)*	-0.381 (0.054)**	-0.246 (0.023)**	-1.862 (0.275)**
A	3.260 (0.270)**	--	-0.869 (0.154)**	-28.802 (1.826)**
B	2.402 (0.295)**	--	-1.350 (0.168)**	-20.191 (1.997)**
C	1.337 (0.270)**	--	-0.748 (0.154)**	-11.961 (1.826)**
D	--	--	--	--
a	9,389 (0,633)**	16.925 (0.829)**	7.731 (0.361)**	61.55 (4.279)**
N	50	50	50	50
Adjusted R^2	0,769	0.495	0.793	0.866

The models in Table 3 show that the average temperature significantly explains depreciation, maintenance, energy consumption and CO_2 emissions. Energy performance D is not significant, meaning that there are no differences between E and D. It is logical to assume this by considering that an E energy rate is reached only in five climatic zones (B4, C1, C2, D1 and D2) and, moreover, that the kilograms of CO_2 obtained almost reaches the upper limit for energy rating D.

Model 1 indicates that the depreciation cost will increase by 1.34, 2.40 and 3.26 euros/m^2 for energy performances C, B and A, respectively.

Model 2 shows maintenance costs and reveals that there are no differences for the various energy ratings. The initial cost of €16.93/m^2 decreases by €0.381/m^2 for each degree of increased temperature in the climatic zone. Temperature explains up to 49% of the variability of maintenance cost. Maintenance work differs little between the ratings as many operations are the same, for example, painting, fire prevention, audiovisual, or ventilation facilities, etc. Such changes are quite insubstantial in the

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global computation of the maintenance costs with just a few operations becoming cheaper from among the 45 routines considered.

Model 3 shows the cost of energy and indicates that temperature and energy ratings C, B and A explained 79% of the value obtained. In this case, the temperature variable has a negative coefficient, indicating as expected that the cost of energy consumption decreases in warmer areas.

Finally, Model 4 shows emissions of kg de CO_2 as a function of temperature and variables of the C, B and A energy rating. All the variables together explain 86.6% of the variability of emissions and have negative coefficients. This means that the warmer areas have lower emissions and these emissions decrease as the energy rating improves. The way the coefficients diminish between the ratings C, B, and A follows a logical and expected pattern as kg of emitted CO_2 is the indicator that the VYP Calener v.01 program uses to qualify buildings. The maximum emission is 61.55 kg per year for ratings D and E, and this decreases at a rate of 1.862 kg for each degree increase in temperature; and 11.96, 20.19 and 28.80 kg for the ratings C, B and A, respectively.

Standardised residuals were analysed in comparison with the established prognostic values to test the linearity and homoscedasticity of the models.

4 Conclusions

The Spanish building industry is presented with an opportunity to achieve a reduction in CO_2 emissions and build with greater energy efficiency. Recent European and Spanish regulations aim to encourage sustainable development of new housing in Spain. The first steps have been taken in this direction with the establishment of climatic zones and issuance of energy ratings. This makes it possible to assign a rating to each housing construction and relate it to investment costs and annual maintenance costs over its lifetime. In addition to the initial investment costs and annual energy costs, we have modelled the annual maintenance costs that would be incurred during the use of the dwelling for all the Spanish climatic zones and for each of the five possible energy ratings. In each zone, improving the energy ratings meant greater initial investments – but maintenance costs remained the same. In contrast, energy costs and CO_2 emissions decrease as energy ratings improve.

According to this study, more energetically efficient dwellings imply higher costs for users, which means that energy efficiency promotion is unlikely to happen. The perspective could change if considering social costs such as those related to CO_2 emissions. According to the model developed for CO_2 emissions, there is a clear decline in emissions as energy performance improves. If this could be monetized and introduced into the global sum of considered costs, there would be more arguments for energy performance improvement. This could be done by establishing an environmental tax for CO_2 emissions.

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Evaluation of The Assessment Criteria to Determine Practical Completion as Provided for in The CIDB Endorsed South African Construction Contracts

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Abstract:
Practical Completion (PC) is a term that is used in the construction industry to signify the completion of the works in part or whole depending on the form of contract in use, and is indicative of a fundamental achievement in the project life cycle. Literature, however, indicates that definitions of PC and its assessment criteria contained in standard contract documents are ambiguous, which have resulted in the interpretation of PC being a major basis for construction disputes (Always Associates, 2011). The problem is compounded in the case of projects that require varying degrees of completion to attain overall PC. Standard South African construction contracts such as the JBCC PBA (2007) and GCC (2004, 2010) and international construction contracts such as the NEC 3 (2005) and FIDIC (1999) do not define the determination of PC as such, but rather leave the assessment of PC to the discretion of the principal agent, project manager or engineer as the case may be; a subjective undertaking that is one of the major causes of disputes referred to above. This paper therefore seeks to establish an unambiguous and standardised definition of PC that would prevent disputes attributable to the definition of PC. The identification of clear assessment criteria to determine PC forms part of this process. Using South Africa as the geographic limitation of the study, the opinions of construction consultants were obtained by using a structured questionnaire survey, which was based on the literature reviewed. The survey was conducted among senior registered architectural, project management and engineering built environment professionals identified through their respective council registers.

Keywords:
Assessment criteria, completion, construction contracts, practical completion.

Abbreviations used

CIDB	Construction Industry Development Board (SA)
ECSA	Engineering Council of South Africa
FIDIC	International Federation of Consulting Engineers (the acronym stands for the French version of the name)
GCC	General Conditions of Contract
JBCC	Joint Building Contracts Committee

NEC	New Engineering Contract
PA	Principal Agent
PC	Practical Completion
PM	Project Manager
SACAP	South African Council of the Architectural Profession
SACPCMP	South African Council of Project and Construction Management Professionals

1 Introduction

The term "Completion" as used in the construction industry is both perplexing and compound (Egglestone, 2006). As a result Practical Completion (PC), a synonym for "Completion" has been at the centre of many construction disputes (Always Associates, 2011). The precise meaning of PC has caused a great deal of difficulty in the industry because the term is not uniformly defined in contracts (Wallace, 1986).

Wallace (1986) states that it is amazing that PC continues to cause disputes in the industry despite the fact that it has always been a common feature in construction contracts. The cases of *Westminster Corporation v J Jarvis and Sons*[1]*; H W Nevill (Sunblest) Ltd v William Press & Sons*[2], and *Emerson Eastern Ltd v EME Developments Ltd*[3]*, to name but a few* among the multitude of cases, serve as a reminder of the complexity surrounding PC (Egglestone, 2006). As a result of similar occurrences Wallace (1986) suggests that the meaning of PC in construction contracts should be addressed via the law. In addressing the matter the law also has to consider the following PC related sub-problems:

- There is no standard construction industry definition or term for PC;
- The definition of PC in standard construction contracts such as the JBCC PBA (2007), GCC (2004), NEC 3 (2005) and FIDIC (1999) is ambiguous;
- The interpretation of PC in standard construction contracts such as the JBCC PBA (2007), GCC (2004), NEC 3 (2005) and FIDIC (1999) is subjective, and therefore open to debate; and
- The occurrence of PC carries a number of significant commercial and legal consequences for the parties involved in a construction project (McLeod & Thompson, 2010).

[1] *Westminster Corporation v J. Jarvis and Sons* (1970) HL, 7 BLR 64
[2] *H W Nevill (Sunblest) Ltd v William Press & Sons* (1981) 20 BLR 78
[3] *Emson Eastern Ltd v EME Developments Ltd* (1991) 55 BLR 114

2 Hypothesis

PC needs to be clearly defined by, inter alia, stating the deliverables which are expected as a minimum, making the certification of PC, or first delivery, non-subjective and more procedural, and thus ensuring consistency. The inclusion of a clear definition will contribute towards significantly reducing the number of conflicts related to PC.

The main hypothesis can be divided into the following sub-hypotheses:

- There is a need for a clear definition of PC.
- Measurable assessment criteria such as aesthetics (architect), functionality (mechanical, electrical, structural and civil), cost–value (quantity surveyor), health and safety (health and safety agent) have to be used to determine PC.
- The determination of PC should be executed by means of a team approach using a criterion based score card.

3 Literature Review

3.1 Construction project overview

As with any other process a construction project has a beginning and an end. The end or completion of a construction project in standard contracts is of great significance because it triggers a number of obligations and consequences such as listed by Pickles (2005):

- *The transfer of the responsibility for the care of the works from the contractor to the employer;*
- *The commencement of the patent defects liability period;*
- *The date when the contract works insurance cover comes to an end;*
- *The contractor's entitlement to have his performance guarantee/surety returned to him, or to have the amount of the construction guarantee reduced;*
- *The contractor's entitlement to the payment of the first moiety or part of retention monies (where retention is provided for);*
- *The beginning of the period of time allowed for the preparation and finalisation of the final account; and*
- *The end of any period of delay for which the contractor may be paying penalties*.

The industry has, however, been beset by a number of disputes relating to the completion of a construction project. As mentioned earlier, these disputes are usually related to the definition and assessment of completion (PC).

3.2 Construction contracts

In general, a standard form of contract for construction projects must entail the following:

- The execution of construction work i.e. alterations, new construction, rehabilitation or renovation;
- Mobilisation of resources to execute the works by providing in house or outsourced labour;
- A set of obligations for both parties; and
- A set date for completion referred to as the date for PC.

3.3 Defining PC

The lack of a standard industry definition or term for PC is largely due to the fact that various forms of construction contracts exist in the construction market. The CIDB (2011) endorses the following forms of contract in South Africa:

- JBCC PBA (2007);
- GCC (2010);
- NEC 3(2005); and
- FIDIC (1999).

Each of these contracts has a unique definition of or term for PC. The research will indicate that this phenomenon has led to different interpretations of PC. A brief narration of these definitions and terms as per the contracts is provided in Table 1.

Table 1: Narrative definition of PC

CONTRACT	TERM	DEFINITION	ASSESSMENT CRITERIA	DECISION MAKER
FIDIC	Taking Over	State where works are complete as per the contract	None	Engineer
GCC	Practical Completion	State when the works have reached a stage which allows their use for their intended purpose without danger or undue inconvenience.	None	Engineer
JBCC	Practical Completion	The stage of completion where the works or a section thereof is substantially complete and can effectively be used for the purposes intended	None	Principal Agent
NEC	Taking Over	State where the contractor has done all the work that the work information states is to be done by the completion date	None	Project Manager/ Engineer

It is evident from Table 1 that there is no standard definition or meaning for PC. PC also does not have a pre-established meaning as a matter of law (Ang, 2006). The matter is further complicated by the reality that a contractor never completes construction work in the true sense of the word, as he remains liable for latent defects which may manifest at any time in the future. As a result of this, many forms of contract indirectly define PC as a state of “less than complete completion”, an inference that PC is that stage of the works where there are no patent defects while acknowledging that there are or could be latent defects. The arguments presented thus far indicate that there is neither a standard definition nor a unified process for assessing PC.

This is surprising, given the fact that PC represents that stage of the works where a substantial portion of the mandatory obligations in the contract have been satisfied. As such, PC is a significant achievement in the life cycle of a construction project (Silver, 2006), which warrants a standardised definition and assessment criteria. Grewal (2009) states that this issue has become even more significant given the volatility of the industry as employers

may be less keen to take possession of completed works due to lack of money to pay the contractor for the work done, whilst contractors wish to leave the site as soon as possible to avoid carrying unnecessary risk for work done. The determination of PC is therefore a complex matter resulting in many disputes as stated hereinbefore.

3.4 PC procedures and protocols

Each standard form of contract has a set of procedures and protocols that the parties to the contract have to complete in order for the works to be certified as complete.

These broadly entail the following:

- PC inspection(s) undertaken by the principal agent (PA) / project manager (PM) / engineer who may be assisted by other members of the design team,
- Identification of defects and compiling a PC defects list, and
- Attainment of PC if the defects are considered to be trivial or rescheduling of a PC inspection if the defects are critical.

Standard forms of contract advocate that the works would be carried out in accordance with the requirements detailed in the contract documents, i.e. the contract drawings and project specifications which specify the minimum standards of acceptable workmanship. A PC inspection therefore determines whether the works have been completed in accordance with these drawings and specifications.

Any deviation from the contract documents is regarded as a defect. The test for PC is subject to a limited test of reasonableness known as the *de minimis* principle meaning that certification of completion of the works should not be refused if there are only trivial defects in the works (Mills, 2011).

3.5 Disputes

A dispute is a disagreement between contracting parties (JBCC, 2007; FIDIC, 1999). The construction industry has quite an unsavoury reputation with regards to disputes. Disputes between contractors and clients are widespread and ever increasing across all types of construction projects (Sally & Fitch, 2011). These disputes may emanate from a number of areas such as:

- Poor workmanship by the contractor;
- Failure to make timely payment;
- Failure to deliver the project on time; and
- Disagreement regarding the achievement of PC.

Disputes are frowned upon in industry because they are time consuming and costly (Sally & Fitch, 2011). It is thus surprising that the industry tolerates an increasing number of PC related disputes, given the fact that the matter seems controllable.

3.6 Establishing a standardised definition for PC

The following observations and/or recommendations can be made from the lessons deducted from the literature review and the related case studies examined:

- PC is easier to observe than to define, as a result the assessment of PC should include a visual survey;

- The definition of PC has to be carefully drafted at the start of a project;
- Qualifying criteria have to be added to the definition of PC at the start of a project;
- The definition of PC has to be accepted by the parties to the contract and communicated to the project team;
- The project team has to establish a list of possible patent and latent defects for the acceptance of or rejection of PC;
- Should there be no definition for PC, PC will mean a state of affairs in which the works have been completed free from patent defects other than those ignored as minor (these minor defects have to be identified);
- If the contractor achieves PC, it implies that the outstanding work has to be completed in an already occupied building, a task which can prove to be difficult. It is advisable that a contract indicates work restrictions, timescales and damages payable in respect of such work (Mills, 2011); and
- The *de minimis* principle applies in the determination of PC.

The regular occurrence of disputes as previously highlighted indicates that it is imperative for the parties to a contract to agree on the basis upon which PC will be determined. Such an approach leads to greater assurance in the agreement between the parties and a higher degree of trust which in turn encourages and facilitates a more successful outcome for all of those involved (Mills, 2011).

4 RESEARCH METHODOLOGY

4.1 Research method

Ndihokubwayo (2008) suggests that the research method affects the analysis of the data, which in turn affects the research findings. In order to preserve the integrity of the findings a descriptive research approach was adopted. This type of research involves identifying a situation as it is through a survey without manipulating it (Leedy & Omrod, 2005). Furthermore, Zikmund (2003, p.55) states that descriptive research seeks to clarify answers to the "who, what, when, where and how" questions. As such, a questionnaire was developed and used as the main approach to suitably address the main objectives of this paper, which sought to clarify the following:

- Who is better suited to determine PC, an individual or should a team based approach be adopted?
- What are the causes of PC related disputes?
- What additional documentation is required for certifying PC?
- When and how can PC related disputes be mitigated?

4.2 Population and sampling

The population (or research sample group) for the research consisted of built environment professionals who are registered with the following bodies:

- SACPCMP professionals;
- SACAP; and
- ECSA.

The built environment is infamous for its low survey response rate and against this background a purposeful targeting process was preferred to increase the response rate and the

confidence level of the responses. In the design of the structure of the questionnaire, the research problem and sub-problems were taken into consideration and it was endeavoured to address them by testing the proposed hypotheses.

The research questionnaire consisted of seven sections that can be summarised as follows:

- Section 1: Background
- Section 2: Level of use and understanding of construction contracts
- Section 3: Definition of PC
- Section 4: Assessment of PC
- Section 5: Documentation of PC
- Section 6: Skills and technical expertise
- Section 7: Research results

5 RESULTS

The number of respondents to whom the survey questionnaire was sent numbered one thousand. Two hundred and thirty five completed questionnaires were submitted from a combination of registered SACPCMP, SACAP and ECSA members, which resulted in a response rate of 24.2%. Response rates in the built environment are usually below 30% according to Crafford (2008). Consequently, the level of responses received can be deemed satisfactory and renders it possible for adequate inferences to be made regarding PC.

Survey Monkey was used to generate data tables and data frequencies for analysis and interpretation of the findings. The researcher's comments and analyses are thus based on these tables. The responses represented an almost equal distribution from the Engineering Construction sector (one hundred and ten responses) and from the Building Construction sector (one hundred and twenty five responses).

This fairly balanced distribution of responses received between the two sectors provides a realistic view of PC from an Engineering and Building Construction point of view. Figure 1 captures the survey findings in respect of the sector of the construction industry to which the respondents belong to.

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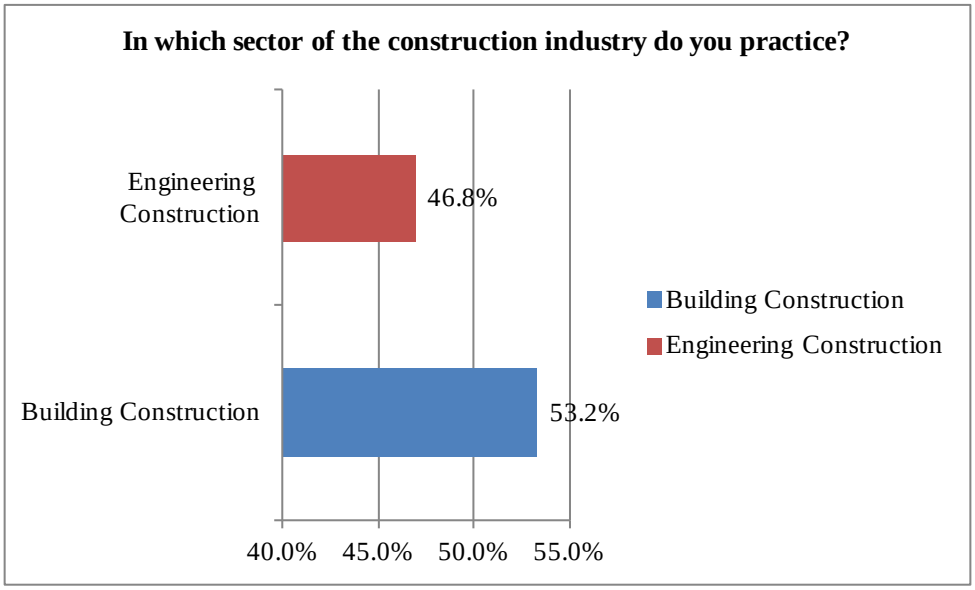

Figure 1: Sector of the construction industry

5.1 Response rates

A researcher should endeavour to use as many techniques as possible to increase the response rate (Zikmund, 2003), and the following additional steps were undertaken by the researcher to boost the response rate:

- The questionnaire was administered in three forms, mainly as a drop-off questionnaire and subsequently via email (with an attached Word version of the questionnaire) and on-line (Survey monkey);
- A reward of R1,000 was offered to one lucky respondent for successfully completing the questionnaire;
- The respondents were assured of anonymity;
- A reminder letter was sent after three weeks, including an additional questionnaire, email and Internet survey prompt request; and
- A reminder email was sent two weeks after sending the reminder letter.

5.2 Profile of participants

The profile for respondents indicates that the majority of respondents in the survey questionnaire where PMs (63.2%) followed by engineers (30.3%) and architects 6.4%). Figure 2 below captures the survey findings regarding which profession the respondents are qualified in.

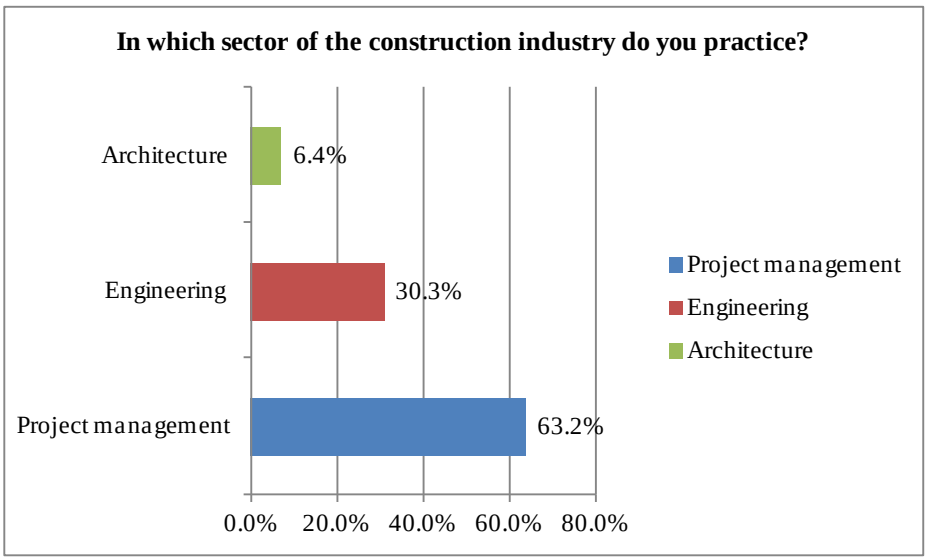

Figure 2: Professional qualification

PMs are often nowadays the key project drivers in the construction industry and they are responsible for making determinations regarding PC in contemporary building projects. Traditionally the architect and engineers were responsible for making determinations regarding PC. As a result the profile of participants is indicative of a fair mix of modern and traditional thinking regarding the questions posed in the survey questionnaire.

5.3 Participants' understanding of construction contracts

Respondents were requested to rate their understanding of construction contracts in use in the South African construction industry namely the JBCC PBA (2007), GCC (2004), NEC 3 (2005) and FIDIC (1999) suite of contracts. Of the total number of respondents 46.4% indicated that they had a high understanding of construction contracts while 41.4% of the respondents indicated an average understanding of construction contracts. The combined total of understanding of construction contracts is 87.5%. An assumption can therefore be made that the responses received can be relied on as being fairly accurate.

5.4 Training profile of participants

Respondents were asked whether they had received any formal training in the use and application of construction contracts namely the JBCC PBA (2007), GCC (2004), NEC 3 (2005) and FIDIC (1999) suite of contracts. Of the total number of respondents 75.4% indicated that they had received some formal training in the use of basic construction contracts, which further consolidated the reliability of the results.

5.5 Most familiar construction contract

Respondents were then requested to indicate which contract suite they are most familiar with. The majority of respondents (47.1%) indicated that they are most familiar with the JBCC suite of contracts. This is in line with the response rate that indicates that the majority of respondents are from the building construction sector. The building construction sector favours the JBCC suite of contracts over other forms of contract. The GCC and NEC follow next in terms of popularity with 26.5% and 17.2% respectively.

5.6 Significance in execution of projects

Respondents were also requested to indicate which items are significant in the execution of a project. The majority of respondents indicated that handing the project over to the client is the

most significant event in the execution of a project. This question was raised so as to appraise the respondents' understanding of what happens at PC. Figure 3 captures the survey results on the significance of items triggered at PC.

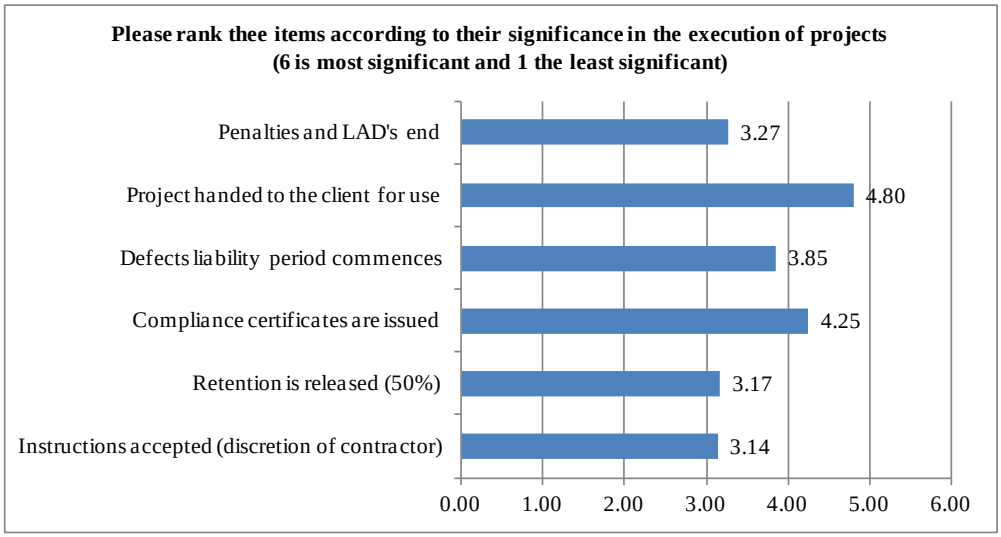

Figure 3: Significance in the execution of projects

6 FINDINGS

6.1 Sub-hypothesis 1

The first sub-hypothesis states that "… there is a need for a clear definition of PC". In view of this, respondents were requested to select the statement that best defines the respondents' understanding of the term PC. It was envisaged that if there is a clear definition of PC respondents would select one common response. The results as captured in figure 4 below however indicate the contrary.

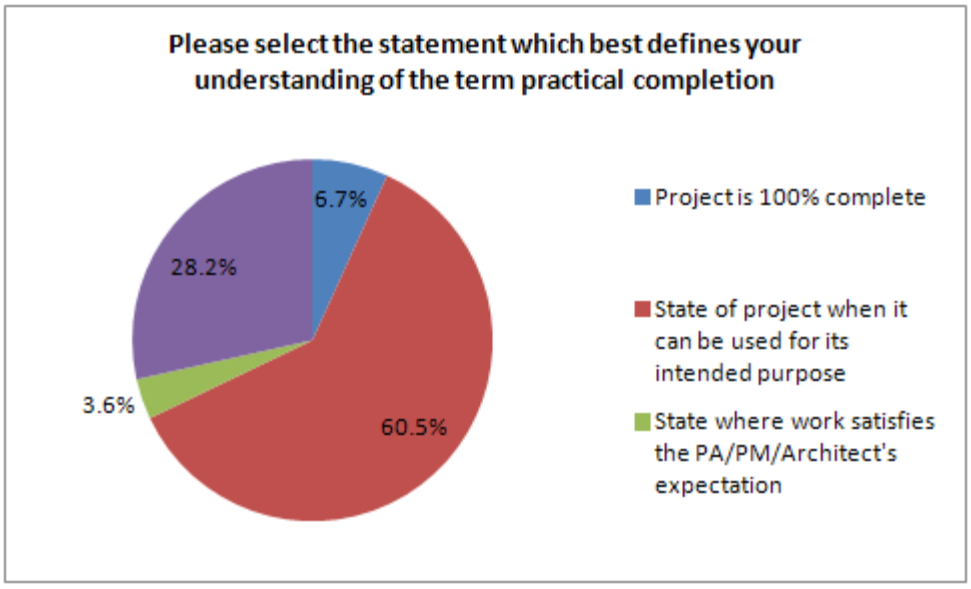

Figure 4: Statement that best defines understanding of PC

The findings indicate that there is no clear definition of PC although the majority (61.5%) supported the statement that PC is the state of the project when it can be used for its intended

purpose. (However, the response by the remaining 38.5% of the respondents still presents a difference in thinking and potential problems in terms of clearly defining PC). There is therefore clear a need for a universal definition for PC.

Sub-hypothesis 1 is therefore supported.

6.2 Sub-hypothesis 2

Sub-hypothesis 2 states that "… measurable assessment criteria such as aesthetics (architect), functionality (mechanical, electrical, structural and civil), cost–value (quantity surveyor), health and safety (health and safety agent) have to be used to determine PC". In order for the researcher to test the validity of this assertion respondents were requested to indicate how in their opinion PC 'could be best defined'. It was envisaged that if there was no need for measurable assessment criteria a common response would be selected.

Of the respondents the majority (66.7%) indicated that PC could be best defined by specifying the expected deliverables, 18.5% of the respondents indicated that PC could be best defined by assessing the client's expectations, whereas 14.9% of the respondents indicated that the PA/PM expectations are a better indication of how PC could be defined. Furthermore, respondents were asked whether they had experienced problems with the way PC is assessed and defined. More than half of the respondents (52.6%) indicated that they had encountered problems with the current process of determining PC.

Respondents where then asked how in their opinion, PC should be defined; that is either by using technical specifications as intimated in the hypothesis or whether contractual rights and obligations had to be clearly indicated to the assessors of PC. The majority of the respondents (61.8%) indicated that PC should be defined using technical specifications which can be used to determine or assess PC.

Respondents were then asked to rate their PC assessments to date as being fair, biased and/or having experienced client interference. Of the respondents, 65% indicated that their assessment had been fair to date, whereas 35% indicated that the assessments were either biased or affected by client interference. The 35% indication of bias and client interference justifies the need for assessment criteria although this sub-hypothesis was not fully supported by the findings of the survey.

It can however be surmised that the majority of the respondents (65%) was coerced due to lack of a sound alternative regarding the good professional standing of the respondents. In other words, respondents told the researcher what he or she wanted to hear rather than the truth (Leedy & Ormrod, 2005).

This assertion was further motivated by the respondents' opinion in response to the question about how the assessment criteria or method is to be defined. Of the respondents 52% indicated that the current assessment criteria are too concise, that it is, too brief and lacking detail, while 48% of the respondents indicated that it is vague or non-existent.

The respondents were then required to indicate what they considered to be the set back in the assessment of PC. Of the respondents, 45.8% indicated that there is a lack of clear deliverables, 32.7% of the respondents indicated that the lack of an assessment framework and documentation is a problem, whereas 21.4% indicated that there is a lack of common assessor skills in the determination of PC.

The respondents were then invited to suggest what they considered to be other setbacks in PC assessment. Of the total number of the open ended responses received, 47% indicated that the definition of PC needed to be clearly stated at the start of the project and that all team members have to be in agreement, so as to adequately assess PC at the end of the project. Issues relating to client interference, a lack of understanding relating to assessment of PC in construction contracts were also raised in the open ended responses.

As a result of the foregoing survey findings sub-hypothesis 2 is supported, which states that measurable assessment criteria have to be used to determine PC.

6.3 Sub-hypothesis 3

Sub-hypothesis 3 states that "… the determination of PC should be executed by means of a team approach using a criteria based score card". The respondents were asked whom to consider as the party who should assess PC. Of the respondents, 55% indicated that the determination of PC should be the PA or designated consultant's responsibility. This was almost twice the number of respondents who felt that there should be a team based approach to determine PC (28.3%). It is also worth noting that a fair portion of respondents (13, 9%) indicated that the client should determine PC.

Furthermore, respondents were asked to indicate the skills that are relevant for assessing PC. Figure 5 captures the survey findings on the skills that are considered relevant for assessing PC.

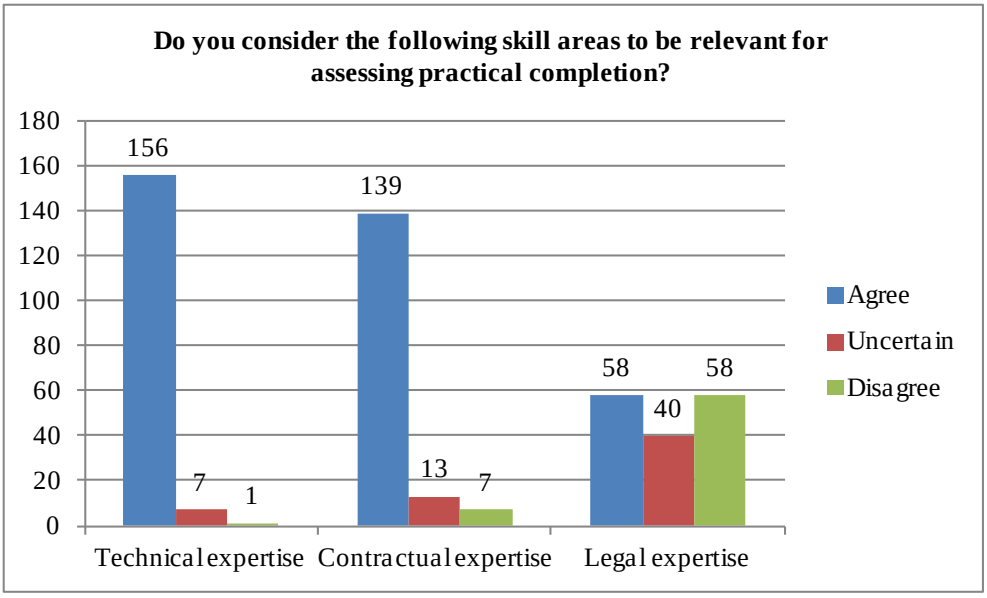

Figure 5: Skills relevant for assessing PC

Respondents were requested to rank the attributes that they considered to be desirable when assessing PC from an individual viewpoint. Respondents indicated that experience and fairness where the most fundamental factors in determining PC. Figure 6 captures the survey findings on desirable characteristics for assessing PC.

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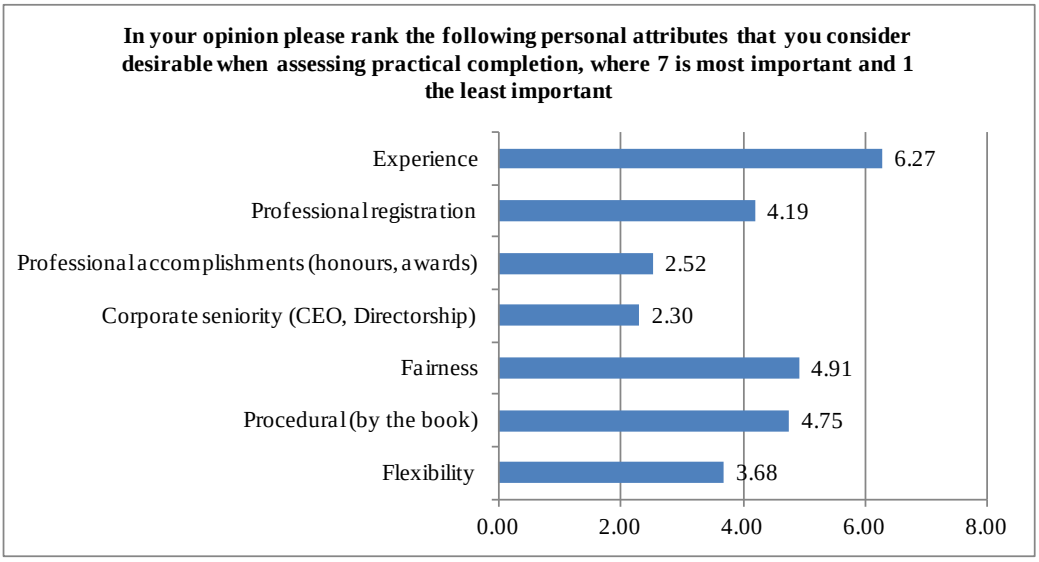

Figure 6: Desirables personal attributes for assessing PC

The findings themselves, however, indicate that the team approach as hypothesised in sub-hypothesis 3 is not supported.

7 CONCLUSION

PC of a construction project has been a source of contractual disputes for a prolonged period of time. Scholars attribute PC related disputes to the lack of a clear definition of PC and the lack of assessment criteria as well as deliverables to assess and determine PC of a project in an objective manner. As a result, the study sought to establish how PC is currently determined in order to determine whether there was a need for the establishment of a universal and clear definition for PC as well as to determine whether objective team based assessment criteria were required to determine PC in standard construction contracts.

A summary of the research findings is provided below:

Sub-hypothesis 1

- PC has to be defined clearly so that all the participants on the project understand exactly what is expected of them;
- PC can be defined per project in order to distinctly define the deliverables by their specifications; and
- A precise definition would assist in preventing or lessening the disputes encountered at PC stage.

Sub-hypothesis 2

- A PC assessment framework will set out the criteria that will be used to determine PC by specifying what is required or expected at PC and how it is going to be assessed by the professional team;
- Formal documentation has to form part of the determination of PC by the client's representative such as certificates of compliance and certificates of occupation; and
- The documentation to be issued at PC should be checked off on a deliverables checklist which can form part of the contract as a technical provision.

Sub-hypothesis 3

- The team approach to determining PC was not supported by the majority of the respondents as most shared the view that PC should remain as part of the duties of the PA/PM/engineer.

From the research findings PC as defined in the JBCC PBA (2007) seems to be the most applicable; this can be slightly modified as a generic definition for construction contracts to read:

> *the state of completion as certified by the PA/PM/engineer where the works, or a section thereof, is substantially complete notwithstanding the presence of minor defects and can effectively be used for the intended purpose as described in the contract data, or when the employer by agreement takes occupation of the works, or part of the works, before the intended or revised date of PC.*

It is envisaged that the use of such a standard definition will result in consistency and fairness vis-à-vis the determination of PC in the construction industry.

Recommendations

- The study has confirmed that the determination and assessment of PC is a subjective process, which, coupled with the ambiguous definition of PC in standard forms of contract, often has the result that the process of achieving PC ends in dispute. The researcher recommends that in the determination and assessment of PC the PA/PM/engineer adopts the principles of objectivity supported by specific assessment criteria to be agreed between the parties at the outset of the project (refer Annexure A for an example of such assessment criteria).
- A formal course on PC assessment (including the consequences thereof) as part of continuous professional development, should be made compulsory for all built environment professionals, who normally assume the role of PA/PM/engineer on projects.

In conclusion it may be stated that the main objective of this study has been achieved and that the development and adoption of a clear definition of PC as well as assessment criteria, coupled with the implementation of the recommendations made, where applicable, would go a long way towards reducing the number of PC related disputes in the construction industry.

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ANNEXURE A: ASSESSMENT CRITERIA FOR PC

The state of completion where, in the opinion of the PA/PM/engineer:

1. Residential: Private dwelling

The works may be occupied by the owner/tenant with minor disruption to carry out remedial work during the defects liability period to achieve final completion;

2. Residential: Block of flats/cluster home/townhouse/hostels

The works may be occupied by the owner/tenant after all remedial work has been completed;

3. Residential: Hotel and/or retirement home

The works may be occupied by the owner/tenant for the purpose of installing built in furniture, fittings and equipment (FF&E) and with minor disruption to carry out remedial work during the defects liability period to achieve final completion;

4. Industrial buildings: Warehouse/factory/distribution centres

The works may be occupied by the owner/tenant for the purpose of installing built in fixtures, fittings, plant and equipment and where loading bays and parking areas are available for owner/tenant use and with minor disruption to carry out remedial work during the defects liability period to achieve final completion;

5. Commercial: Office buildings

The works may be occupied by the owner/tenant with minor disruption to carry out remedial work during the defects liability period to achieve final completion;

6. Commercial: Shopping centres

The works may be occupied by the owner/tenant for the purpose of installing built in fixtures, fittings, plant and equipment and where loading bays and parking areas are available for owner/tenant use and with minor disruption to carry out remedial work during the defects liability period to achieve final completion;

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7. Head office buildings for specific building owner/tenant

The works may be occupied by the owner/tenant with minor disruption to carry out remedial work during the defects liability period to achieve final completion;

8. Buildings for education: Schools/universities/colleges

The works may be occupied by the owner/tenant with minor disruption to carry out remedial work during the defects liability period to achieve final completion;

9. Correctional Services: Prisons

The works may be occupied by the owner/tenant and all remedial work as listed by the PA in a PC list has been completed;

10. Health care buildings: Hospitals/clinics

The works may be occupied by the owner/tenant and all remedial work as listed by the PA in a PC list has been completed;

11. Public buildings: Theatres/museums/libraries/fire stations

The works may be occupied by the owner/tenant for the purpose of installing built in fixtures, fittings, plant and equipment and where loading bays and parking areas are available for the owner/tenant use and with minor disruption to carry out remedial work during the defects liability period to achieve final completion;

12. Other

To be described by the PA in the contract data when preparing the tender enquiry document and should cover the specific building type if not listed.

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New Disadvantaged Business Enterprise (DBE) Requirements for United States Federal Stimulus Funded Projects

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Abstract:
It is policy of the United States Federal Highway Administration (FHWA) to promote increased participation of Disadvantaged Business Enterprises (DBEs), which are defined as for-profit small business that are at least 51% owned and controlled by one or more socially and economically disadvantaged individuals, for federally funded highway construction projects. Through the development and implementation of supportive services programs, the FHWA contributes to the growth and eventual self-sufficiency of DBEs so that they may achieve proficiency in competing for contracts and subcontracts, administered by State Transportation Agencies (STA). When the US Congress enacted the Surface Transportation Assistance Act (STAA) of 1982, it also directed that at least 10% of Federal-aid highway and transit funds be expended with small disadvantaged business firms. These regulations expanded upon the Minority Business Enterprise (MBE) program, which had been in effect since 1972. The American Recovery and Reinvestment Act (ARRA), enacted by the US Congress intended to provide an economic stimulus. When appropriated the ARRA funds brought new requirements for the DBE Program that include a Race Conscious component and apply to all project phases from engineering through project closeout. This paper reviews and provides an analysis the new DBE requirements and their application to ARRA Projects.

Keywords:
Disadvantaged, business, enterprises, effort. Highway.

1 Introduction

The recent American Recovery and Reinvestment Act (ARRA), enacted by the US Congress in February 2009, intended to provide a stimulus to the U.S. economy in the wake of the economic downturn. To date, over $30 billion of the ARRA funds have been allocated for transportation investments, which have been given to states and local agencies. With the appropriation of the ARRA funds, it is the policy of the Federal Highway Administration (FHWA) to promote increased participation of Disadvantaged Business Enterprises (DBE's). New requirements have now been implemented by the FHWA DBE Program that include a Race Conscious component.

The Federal Highway Administration (FHWA) policy was designed to promote increased participation of DBEs in federal-aid highway contracts through the development and implementation of supportive services programs, which contribute to the growth and eventual self-sufficiency of DBEs so that they may achieve proficiency in competing for contracts and subcontracts, administered by State Transportation Agencies (STA). Therefore, when the United States Congress enacted the Surface Transportation Assistance Act (STAA) of 1982, it also directed that, to the extent possible, at least 10 percent of Federal-aid highway and transit funds be expended with small disadvantaged business firms. These regulations expand upon the Minority Business Enterprise (MBE) program, which has been in effect since 1972.

2 Disadvantaged Business Enterprise (DBE) Defined

A DBE is a for-profit small business that is at least 51% owned and controlled by one or more socially and economically disadvantaged individuals, as defined in 49 Code of Federal Regulations (CFR) 26. There are citizens of the United States (or lawfully admitted permanent resident) Member of one of the following groups:

- Black American,
- Hispanic American,
- Native American,
- Asian-Pacific American,
- Subcontinent Asian Americans, and
- Women

In 2000 Western States Paving Co. (Washington State) submitted the lowest bids on two separate Washington State Department of Transportation (WSDOT) subcontracts. In each case, Western States' low bid was rejected in favor of a more expensive bid by a minority-owned contractor. (In one case their bid was actually $100,000 lower than that of the minority-owned firm which was awarded the subcontract.) This occurred because applicable federal and state laws demanded that a percentage of the federal highway money must go to minority-owned firms.

Western States sued in U.S. District Court, and they lost. Western States then appealed the District Court ruling to the 9th Circuit Court of Appeals, who ruled in favor of Western States. The three judge panel of the 9th Circuit Court ruled that WSDOT had failed to prove the existence of lingering effects of past discrimination - underutilization in quota-speak - in the local road building business which is legally required in order to justify the use of racial targets and goals (quotas).

The ruling applies only to recipients of Federal financial assistance from the

- Federal Highway Administration (FHWA)
- Federal Transit Administration (FTA)
- Federal Aviation Administration (FAA)

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located in the states comprising the 9th Federal Judicial Circuit, which only includes the following states: Alaska, Arizona, California, Hawaii, Idaho, Washington, Oregon, Montana, ad Nevada. In addition, this ruling covers the U.S. territories, of Guam, and Northern Mariana Islands.

In 2005, the FHWA issued guidelines to all state DOT's to conduct Availability & Disparity Studies. Disparity Studies found the underutilization of four groups:

- Black American,
- Native American,
- Asian-Pacific American,
- Women

These four DBE groups are considered Underutilized DBEs (UDBEs). The findings determined that the DOT's should implement Race Conscious DBE Programs to address underutilization.

3 Calculating DBE Goals

The 9th Circuit Court stated that race conscious elements must be limited to those parts of the country where its race-based measures are demonstrably needed. Therefore, it is necessary to determine the market area (within an agency's geographic area), where contractors have historically bid on similar contracts. Two goals are now necessary: DBE % goal and the UDBE % goal. Only UDBE participation will count towards the Race/Gender Conscious UDBE goal. DBE participation by Hispanic Males and Subcontinent Asian Males will only count towards the Race/Gender Neutral DBE goal portion. Typical methodologies for calculating a DBE and UDBE Goal includes:

- Determining the Market Area (within an agency's geographic area, all counties where contractors have historically bid on similar contracts
- Obtaining the total number of business establishments listed in the market area using the County Business Patterns databases (U.S. Census Bureau)
- Obtaining the total number of DBE and UDBE business establishments located within the market area using a Unified Certification Program (state specific).

4 DBE Program Contract Administration

New Disadvantaged Business Enterprises (DBE's) Requirements affects the following project phases

- Engineering
- Bidding
- Good Faith Effort's
- Contract Award
- Construction
- Project Closeout

Engineering

Under federally funded projects DBE and UDBE goals apply to professional services. Agencies are required to set DBE and UDBE goals

Bidding

Agencies are required to unbundle contracts and set schedules to facilitate DBE participation. Provide information on contracting opportunities and procedures. Hold pre-bid meeting with primes and DBE's to explain program requirements and RC and RN goals. Implement supportive services program to improve business management. Distribute DBE directory to plan holders. Provide occasions for DBE's to network with primes

Good Faith Effort's

Bidders are required to submit Good Faith Efforts (GFE), which should include:

- Names and dates of publications used by bidder
- Items of work made available to UDBE's
- Names, address and phone number of rejected UDBE's and reasons other firms were selected
- Efforts made to assist UDBE
- Names of agencies contacted to provide assistance
- Any additional documentation to show GFE

Agency must determine if bidder has made a GFE, if the bidder does either of the following things:

- Documents that it has obtained enough DBE participation to meet the goal; or
- Documents that it made adequate GFE to meet the goal, even though it did not succeed in obtaining enough DBE participation to do so.
- Bidder required to submit solicitations of UDBE's
- Names and addresses of UDBE's participating
- Description of work each UDBE will perform
- Dollar amount of participation of each UDBE
- Written documentation of commitment to use UDBE
- Written confirmation from UDBE that is participating

Must ensure documents are complete, accurate and adequately document GFE. Agencies are burdened with making a fair/reasonable judgment, which includes evaluating the following:

- Quality, quantity, intensity of efforts
- Actively & aggressively trying to meet goal
- Efforts of other bidders

Contract Award

Contract award shall be made only to a bidder who makes good faith efforts to meet the UDBE goal. If bidder does document adequate GFE, award of the contract must not be denied on the basis that the bidder failed to meet the goal. (49 CFR Part 26.53). However, bid protests are likely to occur if second and third bidder meet the UDBE goal and low bidder did not.

Construction

During the construction phase of a project, agencies must maintain oversight of prime contractor's activities (subcontracts and goals) to ensure consistency with requirements. The prime contractor must not terminate a UDBE to self-perform the work. If a UDBE is terminated, the prime contractor is required to make substitution of GFE to obtain another UDBE if needed to reach contract goals. Furthermore, it is the responsibility of the local agencies Resident Engineer (RE) to report in their daily reports, the labor, equipment, and materials used by UDBE.

Project Closeout

At the end of a project, the local agencies are required to document and list all subcontractors who worked on the project. In addition, they are required to list materials and supplies obtained from a DBE/UDBE manufacturer which count as 100% of cost toward DBE/UDBE goals, and list all materials and supplies purchased from a DBE/UDBE regular dealer which count as 60% of cost toward DBE/UDBE goals.

5 Conclusions

The Disadvantaged Business Enterprise Program was created to ensure non-discrimination in the award and administration of federally assisted contracts and to create a level playing field on which DBEs can compete for federally assisted contracts. Benefits have included the remove barriers that affect participation of DBEs in federally assisted contracts; and have assisted in the development of firms that can compete successfully in the marketplace outside the DBE program.

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Protecting Highway Construction Workers through Legislation

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Abstract:
In recent years there have been numerous pieces legislation aimed at increasing safety for construction workers. Of particular interest are those relating to the protection of highway construction workers. These include the following, the "Move Over and Slow Down" law, Double Fine Zones, Anti-assault and Battery law. The paper reviews and provides an analysis of the new legislation and it impacts on the construction industry

Keywords:
Assault, construction, highway, protection, workers.

1 Introduction

The main body of all papers should commence with an introduction section which should explain the background and purpose of the paper. Formatting is described in section 2 below. In recent years, the California legislature passed and the governor approved 696 new bills, many of which impact the construction industry. Of particular interest are those relating to protecting the safety of highway construction workers. This includes the following:

- "Move Over and Slow Down" law
- Double Fine Zones
- Anti-assault and Battery law

About ten (10) years ago, the term "road rage" entered the common vocabulary in the United States. The California Driver handbook defines road rage by stating that "Road rage happens when one driver reacts angrily to another driver."[1] Road rage can take many forms, ranging from an extended middle finger and a loud stream of obscenities to actual physical violence. Other common examples of road rage-induced behaviors include tailgating another vehicle to intimidate the other drivers for going too slow, following other motorist who have committed a traffic offense, cutting other motorist

[1] California Drive Handbook

off, etc. The common thread between all of these acts is that they are committed with the intent of punishing or getting revenge on another driver.

Incidents of road rage have been increasing since the 1990's, the American Automobile Association (AAA) Foundation for Traffic Safety reported a 51% increase in road rage incidents from 1990 and 1996. There has been some dispute as to whether this dramatic increase was due solely to an increase in road rage incidents or whether increased reporting of these types of incidents might also have also played a role in the statistics. However, road rage soon became so much of a public concern that in 1997 Congressional hearings were held on the issue. In a recent report published by the National Highway Traffic Safety Administration (NHTSA)[2], the following is stated, "If it seems that there are more cases of rude and outrageous behavior on the road now than in the past, the observation is correct, if for no other reason than there are more drivers driving more miles on the same roads than ever before".

2 Construction Zones and Temporary Traffic Control

When construction work is performed on a highway, highway construction workers often become the target and/or victims of road rage acts. Temporary traffic control (TTC) measures include signs and message boards to warn drivers of workers, slow moving equipment, and closed lanes ahead. Through the use of cones, drums, and delineators, motorists are guided through a highway construction work zone. In addition, motorists are instructed to merge as soon as it is safe to do so and without crossing the cones or drums and reduce peed and be prepared to slow down or stop for highway equipment. In highway construction work zones, travel lanes are often narrowed and/or the highway shoulder is closed. Motorists are advised to watch for bicycles and "share the road" when they are present.

The most common cause of deaths and injuries in work zones are rear-end collisions. In fact, most of the people killed in work zones are drivers and passengers. Motorists are instructed, for their safety and the safety of their passengers, to slow down, allow extra following room between vehicles, merge early, expect sudden slowing or stopping, watch for other motorists changing lanes at the last minute, and to minimize distractions. Lastly, motorists are instructed not stop the vehicles to watch the highway construction work and obey special signs or instructions from workers.

There have been several high-profile cases of California road rage in recent years. In July of 2007, California Highway 138 had to be completely closed down due to road rage directed at construction workers. The highway, which is located near Wrightwood, California, was being widened due to an increase in population and vehicle traffic that had overwhelmed the highway's capacity. During construction of the highway widening project, motorist experienced significant travel delays. A construction worker was shot with BB's, threatened, cursed at, and it was even reported that highway construction workers had food thrown at them.

[2] National Highway Traffic Safety Administration

3 Move Over and Slow Down

In 2007, California, implemented a "move over" law requiring drivers to move over or slow down when they see emergency responder vehicles on the side of the road. A revision of the statute was effective January 1, 2010, which adds an additional category to the list of covered responders (DOT vehicles with flashing amber warning lights) and makes the law permanent. This revision to the existing law was introduced as Senate Bill (SB) 240 by Senator Roderick Wright, District 25 (Inglewood).

The law requires motorists to slow down and, if safe, move over to a lane not immediately adjacent to the stationary vehicle. The law does not apply when the vehicle with flashing warning lights is not adjacent to the freeway or is separated from the freeway by a protective physical barrier. The previous law required motorists to only yield to law enforcement, emergency responders, or tow truck operators who are working on the roadside. According to Caltrans Interim Director Malcolm Dougherty, “Motorists often automatically slow down when they see police or CHP officers…We also want them to slow down for Caltrans vehicles and equipment”.

The Move Over law, which took effect in 2007, requires drivers to move over one lane when emergency vehicles displaying flashing lights are present. It was amended in 2009 to add Caltrans vehicles displaying flashing amber lights. Drivers are required to move over and slow down when approaching a stationary emergency vehicle or tow truck that is displaying flashing amber warning lights, or a vehicle, marked DOT that is displaying emergency flashing or amber warning lights, while it is stopped on the side of a state highway or freeway. The law is designed to reduce the deaths of police officers, tow truck drivers, paramedics, DOT employees, and other emergency personnel who are aiding stranded or injured motorists or involved in road work. California law specifies a fine of not more than $50 per violation as the penalty for failure to comply

4 Double Fine Zones

Due to increased collision-related injuries and fatalities, certain roads are designated as "Safety Enhanced- Double Fine Zones." Fines for violations are doubled in these zones and also in highway construction or maintenance zones when workers are present (CVC §42010). Section 97 of the Streets and Highways Code, relating to highways allow for the provision to designate highway or road segment as a Safety Enhancement-Double Fine Zone. The provision requires the Director of Transportation, in consultation with the Commissioner of the California Highway Patrol, to certify that a segment of state highway meets specified criteria. It allows for the designation to remain valid for a minimum of two (2) years and authorizes the renewal and revocation of a designation, as specified. A state highway segment qualifies for a double fine zone designation by the department as a Safety Enhancement-Double Fine Zone if all of the following conditions have been satisfied:

- The Director of Transportation, in consultation with the Commissioner of the California Highway Patrol, certifies that the segment identified in subdivision meets the following criteria: first the highway segment is a conventional highway or expressway and is part of the state highway system, and second, the rate of total

collisions per mile per year on the segment under consideration has been at least 1.5 times the statewide average for similar roadway types during the most recent three-year period for which data are available, and third the rate of head-on collisions per mile per year on the segment under consideration has been at least 1.5 times the statewide average for similar roadway types during the most recent three-year period for which data are available.

- The Department of the California Highway Patrol or local agency having traffic enforcement jurisdiction, as the case may be, has concurred with the designation.
- The governing board of each city, or county with respect to an unincorporated area, in which the segment is located has by resolution indicated that it supports the designation.
- An active public awareness effort to change driving behavior is on-going either by the local agency with jurisdiction over the segment or by another state or local entity.
- Other traffic safety enhancements, including, but not limited to, increased enforcement and other roadway safety measures, are in place or are being implemented concurrent with the designation of the Safety Enhancement-Double Fine Zone.

5 Anti-Assault and Battery

Legislation has recently been established to protect highway workers against the offense of assault when engaged in the performance of their duties. Prior legislation defined a "highway worker" as an employee or contractor of the Department of Transportation (DOT) engaged in specified activities related to state highways. New legislation expands the definition of highway workers for that offense of assault to include employees of a city, county, or city and county, as well as employees of a contractor while working under contract with the DOT, contractors and employees of contractors while working under contract with a city, county, or city and county, and volunteers. This paper reviews and provides an analysis of the new legislation and its impact on the construction industry.

This piece of legislation began as Assembly Bill (AB) 561, proposed by Assembly Member Wilmer Amina Carter who represents California's 62nd Assembly District, which includes the City of Rialto, City of Colton, City of Fontana, California, and the City of San Bernardino in the County of San Bernardino.

When AB 561 was proposed, an existing law had already been established to protect highway workers against the offense of assault while engaged in the performance of his or her duties, where "highway worker" is defined as an employee or contractor of the Department of Transportation engaged in specified activities related to state highways. AB 561 expanded the definition of highway worker for that offense to include employees of a city, county, or city and county, as well as employees of a contractor while working under contract with the Department of Transportation, contractors and employees of contractors while working under contract with a city, county, or city and county, and volunteers, as defined, and to include additional specified activities related to local roads or streets.

As stated in the California Penal Code under Section 241.5. (a) and Section 1720.4 241.5. (a), when an assault is committed against a highway worker engaged in the performance of his or her duties and the person committing the offense knows or reasonably should know that the victim is a highway worker engaged in the performance of his or her duties, the offense shall be punishable by a fine not to exceed two thousand dollars ($2,000) or by imprisonment in a county jail up to one year or by both that fine and imprisonment. (b) As used in this section, "highway worker" means an employee of the Department of Transportation, a contractor or employee of a contractor while working under contract with the Department of Transportation, an employee of a city, county, or city and county, a contractor or employee of a contractor while working under contract with a city, county, or city and county, or a volunteer as defined in Section 1720.4 of the Labor Code who does one or more of the following:

- Performs maintenance, repair, or construction of state highway or local street or road infrastructures and associated rights-of-way in highway or local street or road work zones.
- Operates equipment on state highway or local street or road infrastructures and associated rights-of-way in highway or local street or road work zones.
- Performs any related maintenance work, as required, on state highway or local street or road infrastructures in highway or local street or road work zones.

6 Conclusions

Concern over the increase in highway worker deaths, the California Department of Transportation (Caltrans) has partnered with the California Highway Patrol (CHP) to provide enhanced speed and DUI enforcement in highway construction and maintenance zones across California. Four (4) Caltrans workers died in traffic-related incidents during the 2011 calendar year. Three (3) were killed within 48 days, during the months of May and June. The deaths reversed a steady trend of reduced fatalities, which is partially attributed to the "Slow for the Cone Zone" public awareness campaign, which was established in 1999. A total of 178 Caltrans workers have died on the job since 1924. The partnership between Caltans and the CHP has resulted in CHP officers parking their patrol vehicles within construction work zones. Caltrans hopes that the presence of the officers will help to slow traffic or encourage vehicles to move over at least one lane from a highway work zone, as required by the Move Over law described above.

The CHP now employs one or more additional enforcement vehicles at some construction work zones. The presences of the CHP officers are to enhance and ensure safety, and will ticket drivers traveling too fast in work zones.

"Adhering to this law can mean the difference between life and death," said CHP Commissioner Joe Farrow. "The only way to prevent tragedies from occurring on the side of the road is by giving emergency personnel, highway workers and the public some space."

In order for motorist to be motivated by the threat of fines, they must at least be aware that the fines exist. Warning signs should be consistently used on roadway construction

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projects to increase public awareness. Through the Internet, public service announcements, billboards and other media further partnership is recommended between Caltrans, the CHP, the California Office of Traffic Safety, and the Department of Motor Vehicles to increase awareness of the aforementioned laws.

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Removing the Legal constraints for Public-Private Partnerships: A Comparative Study of New Zealand and China

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Abstract:
Public-Private Partnerships have been widely used to deliver public infrastructure and services. An enabling legal framework is essential for smooth PPP application. This paper is aimed at examining the legal constraints for PPPs and exploring possible solutions to remove the constraints. Comparative case studies of PPP practices in New Zealand and China were adopted with semi-structured interviews as main data collection method. The results show that the New Zealand's legal system generally allows the adoption of PPPs, although some Acts impose procedural requirements on obtaining approvals and land acquisition. The challenges with legal framework in China are multi-faceted and mainly reflected in: (1) uncertainty of the legitimacy of the government to enter into PPP contracts; (2) indirect constraints such as insufficient protection of property rights and potential risks of appropriateness, limitations on private asset and land ownership, and impediments for obtaining approvals by the private sector; and (3) fragmented and inconsistent legal base. The research suggests that to address the legal constraints, the public sector is required to set up effective governance structure, develop strong leadership, be consistent with its policy and commitment, promote standardised PPP legal or guideline document, and take on more risks.

Keywords:
China, legal constraints, New Zealand, Public-Private Partnerships (PPPs)

1 Introduction

Public-Private Partnerships (PPPs) have gained increasing popularity across various countries in the provision of public assets and associated services. The infrastructure sectors in which PPPs have been applied include roads, urban rail, water and wastewater, power station, hospital, schools and prisons (Grimsey and Lewis, 2005, Kwak et al., 2009). PPPs have captured much attention by governments due to the perceived benefits such as better risk allocation, improved quality of services, and alleviation of public budgetary constraints (Cheung et al., 2009, Li et al., 2005). International practices suggest that not all PPP projects have achieved equal success. A

number of researchers such as Zhang (2005), Mahalingam (2010) and Aziz (2007) identified that lack of enabling legislative framework is one of the main reasons impeding the fruition and successful implementation of PPPs. Issues in relation to legislation, such as restrictions on Direct Foreign Investment (DFI) and prohibitions on private sector participation in the long-term operation and management of public services, are likely to pose considerable constraints on the adoption and application of PPPs (Adams et al., 2006, Zhang and Kumaraswamy, 2001).

This research aims to investigate the possible legal constraints inhabiting the use of PPPs and suggest workable strategies to address the constraints and further facilitate PPP implementation. In order to achieve the objective, comparative studies of New Zealand and China PPP practices were conducted with a special focus on the legislative and regulatory aspects. Semi-structured interviews were used as the main data collection instrument to investigate whether the participants envisage problems in the development of PPP programmes that are caused by lacking of enabling legal framework. By drawing on similarities and differences on the legal regime of PPPs between the two countries, improvements to PPP-related legislation and regulative provisions are suggested.

2 Literature Review

2.1 Importance of enabling legal framework for PPPs

The legal framework regulates the limits in which the government and private entities work (Aziz, 2007). Adequate legal framework provides a foundation for public procuring authorities to structure a PPP procurement process and establish contractual relationship with the private sector partner that are pursuant to the host country's legislation (Zhang and Kumaraswamy, 2001).

Researchers such as Chan et al (2010) and Grimsey and Lewis (2004) stressed that the attraction of prospective PPP projects to the private sector entities largely depends on the environment where the projects are undertaken. Lacking of an enabling legal framework, the legitimate rights of the private sector cannot be guaranteed, resulting in potential risks, especially the political risks like expropriation and nationalisation (Wang et al., 1999). Without an adequate legal basis in place, the public interests are likely to be threatened as given the limited number of capable participants to finance and bid for PPPs, PPP procurement may create a non-competition situation, aggravating the risk that the right partner is not selected. Also, lack of sufficient legal provisions to protect the public interests, the quality of public services may be compromised as the private sector partner is likely to opt for sub-optimal service solutions in order to achieve excessive profits from participating in PPPs.

2.2 Legal constraints for PPPs

Despite the importance of an enabling legal framework for the adoption and application of PPPs, a wide range of legal constraints for PPPs have been identified from past global PPP experiences. Generally, the legal constraints primarily manifest in three main categories:

2.2.1 Direct restrictions on the adoption of PPPs

In some countries, there are explicit legal provisions that prohibit the use of PPPs in infrastructure development. The prohibitive provisions cover various aspects, including the restrictions on the private sector's involvement in the operation and management of public services, constraints of long-term leases or ownership of public assets or land, limitations on the private sector to exert third-party charge (e.g., tolls) for the usage of public services, and restraints on the private sector to wholly, or partly invest in the provision of public assets (Algarni et al., 2007, Grimsey and Lewis, 2004).

2.2.2 Indirect constraints for the smooth implementation of PPPs

Researchers such as Adams (2006), Li (2005) and Aziz (2007), found that in addition to clearly specified legislation precluding the private sector's participation, legal constraints exist that will indirectly impede the application of PPPs. For example, in Australia, some PPP models (e.g., full-service model, incorporating "core services") are excluded from the spectrum of PPPs when selecting the delivery method (Jefferies and McGeorge, 2009). In Europe, prior to the introduction of "Consolidated Directive on public procurement and concessions in 2004, the previous European Union (EU)'s public procurement rules could not sustain highly sophisticated procurement, like PPPs (Savvidese, 2011). In China, despite the release of laws concerning property rights, the private sector's concerns still exist that their rights specified in the PPP contract cannot be properly protected under the current legal system (Adams et al., 2006).

2.2.3 Inconsistencies of legal provisions between various levels of governments

Sometimes the legal and regulatory provisions or policies are not consistent among different levels of governments, as suggested by Chen (2009) and Yuan (2010). PPPs may be allowed under central government whilst the provincial or municipal government precludes the private sector's participation in public works. Also, the regulations in different sectors governing the capital asset management may vary regarding the permission of PPP use (De Jong et al., 2010).

2.3 Responses to the legal constraints for PPPs

Differing strategies have been adopted to respond to the legal constraints for PPPs. Competitive Dialogue procedure was introduced to the EU for complex procurements (e.g., PPPs) to provide policy, legal and institutional frameworks for PPPs (Savvidese, 2011). The use of Competitive Dialogue assists with maintaining competition between the private participants and ensuring the contracted party have the required capacity to fund and operate PPPs (KPMG, 2010). In the UK, Australia and Canada, a suite of PPP guidance and policies have been developed, detailing the PPP procurement processes, requirements for contract management and guidance on value for money assessments (Aziz, 2007). Carrillo (2008), Dixon (2005) and Zhang (2005) believed that such guidelines and policies offer a basis for structuring and implementing PPPs under a stable and enabling legal and regulatory framework. Chen (2009) and Wang (1999) maintained that for developing countries like China, large international organisations, such as the World Bank and the Asia Development Bank played an important role in identifying and resolving the emerging legal issues, ranging from ensuring a transparent and competitive tendering process, establishing appropriate payment mechanisms, and ensuring contract enforcement. For countries where the large international organisations

are not accessible, the appointment of highly-skilled legal advisors, under the conditions that the legal fees will not compromise the value for money outcomes, is claimed to be essential to guarantee that the possible legal constraints are sufficiently addressed along the procurement process (Akintoye et al., 2003, Carrillo et al., 2008).

3 Research Methodology

Comparative case studies were adopted in this research and interviews were used as the main data collection method. The main reason for choosing case studies strategy is that the legal aspects of PPPs are closely related to the country's policy, institutional, economic and social context and the case study approach is preferred in examining phenomenon within its real-life context (Yin, 2009). Comparative case studies of New Zealand and China's legal aspects associated with the adoption and implementation of PPPs provide opportunities to understand the variations arising from diversity across policy contexts, based on which recommendations can be made on removing the legal constraints for PPPs. A qualitative interview method was selected as it provides in-depth insights and perspectives on a subject matter, which is desirable in this research for seeking rich and insightful information on the key dimensions of legal issues of PPPs (Mcneill and Chapman, 2005). In addition, a qualitative approach is suitable when little is known on the topic as is the case with investigating the legal aspects surrounding PPPs.

Fieldtrips to Auckland, Wellington (from November 2010 to April 2011) and Beijing (from July 2010 to August 2010) enabled the data collection exercise. The participants of the interviews were selected via a purposeful sampling procedure as it allows the selection to be narrowed down to specific group of people who can provide rich information on the subject matter (Liamputtong and Ezzy, 2005). The research targeted practitioners with extensive PPP experiences (more than ten years), familiar with the PPP policy context in respective jurisdictions and knowledgeable about legal-related issues about PPPs. All the practitioners selected hold senior positions in their organizations (at executive level). In the China's case study, three interviews with academics with extensive PPP-related research experience were conducted to gain a more holistic understanding of China's evolving approach and context of PPPs. The profile of participants interviewed is presented in Table 1.

Table 1. Profile of participants interviewed

	New Zealand	China
Public sector	NP1-NP2	CP1-CP3
Private sector	NR1-NR4	CR1
Legal/commercial advisors)	NA1-NA4	NA
Academics	NA	CA1-CA3

Seventeen interviews were undertaken (ten for New Zealand and seven for China). The participants were approached through email or telephones. Semi-structured interviews were used to solicit reliable and comparable qualitative data whilst allowing a high

degree of flexibility during the interviews. The main themes explored in the interviews include:

- The effectiveness of current legal frameworks to sustain a PPP programme
- Possible legal constraints preventing the adoption of PPPs or impeding PPP implementation
- Measures that have been taken to address the emerging legal constraints
- Additional strategies proposed to remove the legal constraints and further facilitate the PPP development

The recorded interviews were transcribed, coded and analysed using with the assistance of qualitative analysis software – NVivo 9. The use of the software enabled the researcher to develop themes and patterns and sort through the data accordingly in order to compare, contrast, and synthesise. Pattern-matching techniques were adopted to link the findings based on case studies data to the conceptual framework (Platt, 2008).

4 Research Results

4.1 Case Study of New Zealand

4.1.1 PPP practices and policy context

In New Zealand, the private sector has been involved in the provision of public works and related services for many years. The experiences with PPPs were nonetheless limited (New Zealand Office of the Auditor-General, 2011). The main PPP projects were undertaken at local government level, including water and wastewater projects. (Grimsey and Lewis, 2005). The scarcity of PPP practices was partly due to the New Zealand government's sceptical view towards the adoption of PPPs (Ascari Partners Ltd, 2005). For example, the Treasury's discussion paper concluded that the benefits of using PPPs may also be achieved in traditional ways (Katz, 2006).

The New Zealand government's approach to PPPs has changed since the government announced its infrastructure policy and support for the development of PPP programmes in 2008. A PPP project will proceed as long as it can demonstrate value for money (National Infrastructure Unit, 2010). Proposals with whole of life costs more NZ$25 million are required to include a PPP option in the choice of procurement route (The New Zealand Treasury, 2011). Since 2008, two social infrastructure PPP projects– the new prison at Wiri and two new schools in Hobsonville have been brought into market.

Relevant policy settings have evolved around PPPs to facilitate the PPP implementation. A central coordinating authority – National Infrastructure Unit (NIU) was set up within the Treasury in 2009 acting as a centre of excellence for PPPs. A number of policies and guidelines that are specific to PPPs are available, including *Guidance for Public Private Partnerships (PPPs) in New Zealand* (National Infrastructure Unit, 2009), *Draft Public Private Partnership Standard Contract - Version 2* (National Infrastructure Unit, 2011).

4.1.2 Legal constraints for PPPs

When asked of the perceived legal constraints for PPPs, all New Zealand participants indicated that there are no substantial legal constraints preventing the adoption of PPPs. As a response to the government's infrastructure development policy, a legislative reform has been underway and a series of acts have been reviewed to remove the unnecessary barriers impeding the use of innovative delivery models for public infrastructure and services (e.g. PPPs). For instance, prohibitive provisions on PPPs, such as the restrictions on private sector management of prison services in Corrections Act (2004) and limitations on concession period of private sector operation of water projects specified in Local Government Act (2002), have been removed from legislation allowing the use of PPPs in prison and water sector (National Infrastructure Unit, 2010). In addition to the recent changes, the Land Transport Management Act (2003) allows for limited tolls and private sector involvement in the operation and management of roads (Ascari Partners Ltd, 2005).

All participants admitted that although PPPs are possible under the current legislative framework, legal constraints exist that will hinder the smooth implementation of PPPs. Eight participants emphasised the Resource Management Act (RMA) (1991) are likely to cause delays to the procurement process and compromise the innovative solutions by the private sector. For example, Participant NA1, NP1, NR1 and NR3 explained the ways in which the RMA impacts on New Zealand's PPPs,

In New Zealand, you have to design things to a very developed design stage before you will be able to get your designation under RMA, which means the procurement is likely to be delayed. You will get very little opportunity to innovate when it comes to the private sector participation (NA1).

Ensuring that you get the use of the site you need for the procurement you are undertaking and you can do it in a way that it doesn't constrain the solutions that the private sector might generate. So we have to go about developing a designation process under RMA that removes the constraint as possible (Synthesis of opinions of NP1,NR1 and NR3).

Participant NP2 and NR4 further pointed out that the effects of procedural requirements imposed by the RMA have been seen in New Zealand's current pilot PPP project – Wiri Prison and the previous PPP endeavour – Vector Arena. For example, in the case of Vector Arena, as mentioned by Participant NR4, the delegation process undertaken in accordance with the RMA was lengthy, causing delays to the project's overall timeline. After the appointment of the initial preferred bidder – Abigroup, the RMA delegation was obtained via a prolonged consultation process. However, the process was further delayed after the second preferred bidder – Quay Park Arena Management (QPAM) Ltd was selected as the private sector partner as another RMA delegation application was lodged followed by a similar protracted process. Participant NP4 and NR4 maintained that the prolonged delegation process was part of the reason the project experiencing time delay.

Five participants stressed the likely legal constraints arising from the Public Works Act (PWA) (1981) on the acquisition of land for PPPs. Although the PWA granted the

Crown with statutory authority to acquire land for a public work, it also requires a series of steps to acquire land, resulting in long transaction duration for potential PPP projects. As highlighted by Participant NP2 and NR4, in New Zealand, the issue with land acquisition is especially critical due to the country's special legal document – Treaty of Waitangi, which allows Iwi (regionally linked tribes) to institute compensatory claims of historic ownership of land. Participant NP1, NP2, NR4 and NA2 argued that for any New Zealand PPPs, the requirements by Treaty of Waitangi must be addressed and consultation with iwi is vital if the intended site is owned by them.

New Zealand's legal constraints for PPPs are also reflected in the evolving nature of legislation over time, as argued by six participants. They further elaborated that the unstable legislative terms regarding the use of PPPs is party as a result of New Zealand's short election cycle (3 years). The National Government explicitly signalled the encouragement of infrastructure spending and private sector participation, whereas the Labour Party appears to hold a negative view towards the value that PPPs could bring to New Zealand, as observed by the participants (NA1, NA2 and NR2). The participants' point can be confirmed by the case of Auckland Central Remand Prison (ACRP) project, which has undergone a process of "private management – hand back – private management". When the project first came to operation, the then National Government granted the prison operation and management to a private company – Australasian Corrections Management Pty Ltd (GEO Group, 2009). After a five-year's management by the private company and the Labour Government came to power, the control of the project was reverted back to the Public Prisons Service in 2005 due to the passing of the Corrections Act 2004 specifying that only the public sector authorities can provide correctional services (Department of Corrections, 2011a). In 2011, a new correctional facility named Mt Eden Corrections Facility (MECF) was completed and the ACRP was incorporated to the new facility (Department of Corrections, 2011b). The management of the project was again transferred to a private company – Serco as the Corrections (Contract Management of Prisons) Amendment Act, passed in 2009 (under the current National Government), allowing private sector entities to tender for contracts to manage the operation of prisons, on a case-by-case basis (New Zealand Parliament, 2009). As argued by Participant NP1, the change of legislation in terms of the permission of private sector's participation in contract management of prison services mirrors the New Zealand's unstable legislative base for the adoption of PPPs.

4.1.3 Strategies suggested to remove the identified legal constraints

In terms of the measures that have been taken to address the legal constraints for PPPs, eight participants emphasised the importance of having a clear and standardised approach towards the selection and implementation of PPPs and they added that the government has made great effort in achieving this. For example, the recently released guideline document *Better Business Cases for Capital Proposals Toolkit*, has explicitly specified the criteria under which PPP procurement option may be selected and a specific approach for seeking approval from Ministers and approaching the market. As indicated by Participant NP2 and NA3, the transparent selection criteria and approval process provides a legal and regulatory basis for the public agencies to proceed with a PPP. In addition to a clear and streamlined procedure for the selection of PPP candidate projects, the participants advocated a standardised and consistent approach towards the realisation of PPPs. Establishing, updating and consistently applying policies and

guideline documents were perceived effective to enable the institutionalisation of PPP procurement and transaction. Participant NP1, NP2, NA1, NA2 and NA3 stated that the New Zealand government has made a substantial progress in terms of publishing and applying PPP guidance. With respect to the two available PPP-specific guidance documents, the participants gave positive comments:

…The Guidance is a good first tier document although it is fairly high level and not detailed enough to guide people with the practical procurement. (Synthesis of views of NP2 and NA1)

…New Zealand documentation (the Standard Contract) is very clear and concise. And in vertical, it is very fair in the way which applies the obligations on the Crown and the contract. It is structured understanding the basic positions to be reached. It is the right balance. (NP1)

Six participants stressed that setting up effective governance structure is essential for ensuring that all possible legal and regulatory constraints are identified and the responding mitigating methods are in place. As stated by Participant NP2 and NA4, a steering committee is required to be formed at initial stage and meet on a regular basis (monthly is common). A core group comprising of the experts from NIU and the representatives from the agencies is necessary and they should be meeting on a more frequent basis (perhaps weekly). Through the contact of the core group and the steering committee, the public sector is able to reflect on the potential legal barriers (e.g., lengthy resource consenting process as required by RMA) and respond to problems raised on time.

Four participants argued that a committed and dedicated public procuring team, coupled with strong leadership are useful means to alleviate the negative effects of legal constraints on PPP implementation. Participant NP1 stated, “In practice, we need to stick to what we have said…We promise something in market sounding. The commitments need to be followed through…We should always follow the timeframes we set up in the beginning.” (NP1) The public sector’s strict adherence to their commitments and timelines helps to guarantee that any delays or problems arising from the requirements of RMA or land acquisition issues can be dealt with promptly. Strong leadership assisted by the central PPP unit – National Infrastructure Unit is beneficial to make sure that the required decisions are made and the necessary approvals are obtained in accordance with the pre-determined timeframes, maintaining the private sector players’ confidence in participating in New Zealand’s PPPs.

Six participants asserted that in order to address the private sector’s concerns in relation to legal and regulatory issues, the government should take on more risks in New Zealand PPPs. For example, Participant NP2 advised that the public sector could assist with obtaining the relating approvals and conducting site investigation. For example, “the RMA consenting process would have been done before the project goes to market to avoid delays…We might take site investigation and make those reports available to bidders to alleviate from having to do it themselves (the private sector).” (NP2) With respect to the legal constraints (e.g., prohibition on the private sector to be involved in long-term management and operation of public assets) arising from political risks, the participants suggested that the government should retain risks of this type. The ways to

address the risks include promise to compensate (to a capped amount) the bidders in competition if the PPP project was cancelled due to the change of government.

4.2 Case Study of China

4.2.1 PPP practices and policy context

In China, PPPs have been implemented in a variety of sectors such as water and wastewater, venues, land transport and power station, mainly in the form of build, operate, and transfer (BOT) (Wang et al., 1999). The initial initiative for the government to opt for BOT was mainly to relieve the public budgetary constraints, especially in the area of public infrastructure (Chen and Wang, 2009). The concept of Public-Private Partnerships was officially introduced by the Chinese government with the release of policy note *Suggestions to Promote and Guide Private Investments* (De Jong et al., 2010). A report *Suggestions to Advance Marketisation in Civil Infrastructure Industries* issued in 2002 introduced a dozen more PPP projects using diversified PPP models (e.g., the National Stadium for Beijing Olympic Games – the Bird's Nest) (Liu et al., 2009).

China's PPPs are initiated by both central and local government (Chen, 2009). However, compared to other countries in which PPPs are mainly promoted by central government, local governments in China have shown more interests in engaging with the private sector to advance the infrastructure. This is probably attributed to the institutional change in 1994 – tax sharing reform, under which the majority tax incomes are collected by central government whilst the capital expenditure responsibilities remaining with the local governments (Chen and Wang, 2009). Facing the funding gap to sustain infrastructure development, local governments tend to refer to the private sector investors to address the bottleneck via the adoption of PPPs.

In countries like the UK, Australia and Canada where relatively mature PPP markets have been established, a suite of policy and guideline documents have been developed ranging from the technical note on assessment of value for money, model risk allocation matrix, key commercial principles, to contract management guidance (Infrastructure Australia, 2008). However, in China, the guidelines for PPPs are very limited with few documents setting out specific legal directions for PPP project, such as the Method of Managing Urban Public Utilities Concessions (2004) (Chen and Wang, 2009).

In China, the informal personal connections between government officials and representatives from some State-owned enterprises or potential private companies gives rise to moral hazards, leading the market to cast doubt on the fairness and transparency of the tendering exercise (De Jong et al., 2010). The situation is worsened when negotiated selection procedures (common for PPPs) are used rather than open tendering as lacking of a transparent process and evaluation criteria, risk may arise that weaker proposals are chosen (Yescombe, 2007).

4.2.2 Legal constraints for PPPs

According to all participants, China has substantial legal and regulatory restrictions on the private sector involvement in public sector procurement. Despite the availability of a number of policies and status allowing the private sector participation in some

infrastructure sectors, uncertainties prevail concerning the legitimacy of the government to enter into PPP contracts. Participant CA1 and CA2 elaborated that in China, PPPs are mainly practised in sectors such as power generation, water and wastewater, land transport and public transport. However, the PPP application in some infrastructure areas, such as schools, hospitals and prisons is restricted in China under the current legislative system. There are also restrictions on the private investment in the public infrastructure and the associated services. For example, Participant CP1 and CP2 stated that in the case of Beijing Metro Line 4 project (in which PPPs were used), the government was only allowed to introduce private investment at the ratio of 7:3 (governmental investment: private funding), under the requirement of *Suggestions on Improving Financing Mechanism for Unban Infrastructure*, issued by the Beijing Municipal Commission of Development and Reform. Participation CP1 further added that the formation of the Joint Venture Company (also referred as "Project Company", acting as an investment vehicle) between the public sector and private investors, should follow the legislation concerning foreign capital injection: Chinese entities' shareholders' equity shall not be lower than 51%. As suggested by Participant CP1, CP2, CA1 and CA2, the restrictions on the government to enter into PPP contracts and limits on Direct Foreign Investment (DFI) in the public infrastructure regime help to ensure that public interests are protected. However, the relevant regulations would considerably limit the potential to utilise private financing and affect the private sector's interests and confidence in participating in China's PPPs.

In addition to direct restrictions on the adoption of PPPs, other legislation, regulations and government policies indirectly impose constraints on the implementation of PPPs in China. Although new legislation protecting private property was released, concerns still exist among the prospective private investors regarding asset ownership, as maintained by Participant CA3. Participant CR1 and CA1 mentioned that the commercial law in China also poses constraints to PPP formation as the Project Company is required to have a minimum registered capital of the total estimated investment. Moreover, the restrictions on private acquisition of land and the right of land development affect the adoption of PPPs, as pointed out by Participant CP1, CP2 and CA2. For example, commercial land exploitation surrounding urban rail links assists with enhancing private benefits, making the urban rail projects financially viable and sustainable, but the ability to achieve this is problematic in China due to the lack of stable legislation permitting private land exploitation. In the case of Extension of Shenzhen Subway Line 4, because the public land cannot be sold to the private entity, the private consortium is only allowed to undertake commercial development along the metro lines, leading to the reduction of the private investor's interest in this project (De Jong et al., 2010). Participant CP1 and CP2 highlighted this issue using the example of Beijing Metro Line 4 project, in which the Hong Kong Mass Transit Railway (MTR) was appointed as the private sector partner. In Hong Kong's metro business, MTR is involved in a variety of activities apart from railway operations, including the development of residential and commercial projects, property leasing and management. However, this mode cannot be replicated in this case because commercial land and property development is restricted by the government. Besides, in the Beijing project, MTR was not allowed to run any additional businesses in subway stations (e.g. bookstore, convenience store, etc.), which formed part of MTR's revenue sources in their business in Hong Kong. So ticket sales and advertising incomes were the main revenue sources for MTR. Without being

granted the rights to undertake commercial development and running subway station businesses, the private sector partner tended to take a cautious approach when stepping into China's PPPs and request for government subsidies to bridge the gap between expected return on investment and actual income from ticket sales.

All participants highlighted that in China, the legislation, regulations and policies in relation to private sector involvement are enacted at different levels of governments (central, provincial, and municipal), dealing with different aspects of PPPs. Sometimes conflicting policies exist. For example, Participant CA3 argued that the central government does not permit governments providing guarantees in attracting private investment. However, for some local governments, the officials tend to provide guarantees to PPP projects in order to attract prospective private investors to alleviate the financial burden to fund infrastructure projects. The discontinuity of legal base at different levels usually causes confusions to the prospective private sector players, hindering the PPP development in China. Participant CR1, CA1 and CA3 claimed that the fragmented legal and regulatory base for PPPs is likely to impede the PPP approval and subsequent procurement and implementation process. The approval process for PPPs normally involve various government departments at different level (central, provincial and municipal), who resort to different legislation, policies and statues to proceed their decision making, rendering the PPP approval process cumbersome and lengthy and discouraging the private sector players to bid for PPP projects in China.

4.2.3 Strategies suggested to remove the identified legal constraints

With respect to the substantial legal constraints for China's PPPs, all participants agreed that the fruition of PPP proposals requires a political champion and continuing political commitment. Participant CP2 and CP3 articulated the case of Beijing Metro Line 4 to illustrate the point. During the project development and procurement, the heads from government were involved in the project steering committee and well informed at various decision-making points. As stated by CP2 and CP3, the involvement of senior government officials and keeping them informed helped to ensure that the government was able to respond to tricky issues as a result of legal and regulatory constraints and take commensurate measures to address the issues promptly and in an efficient manner.

Five participants held a view that having a highly-skilled and experienced public procuring team with strong leadership is vital for resolving the emerging legal concerns when initiating, structuring and implementing PPPs. They generally acknowledged that lacking a central PPP unit acting as a centre of expertise and providing commercial advice to line agencies, it is difficult for public procuring authorities in China to apply a consistent approach to towards the execution of PPP projects. However, Participant CP1, CP2 and CA2 highlighted that it would be of great benefit to have a core team comprising of experienced experts who are familiar with the structure of PPPs and specialised in the financing and development of PPP projects. Again, Participant CP1 and CP2 cited the Beijing Metro Line 4 case, articulating the important role played by the project procuring team:

In Beijing project, the Beijing Infrastructure Investment Company Ltd. (BIIC, a state-owned enterprise), acting as both a contracting party and public procuring authority, provided a platform to carry out the project on behalf of the government.

As a part of the joint venture company, BIIC devoted 2% of the equity injection. As a public procuring authority, BIIC released the initial financing plan, completed the feasibility study, and planned and implemented the procurement. With sufficient empowerment from the government, the project team could effectively respond to the private sector partner's concern about profitability arising from the legal constraint prohibiting commercial land exploitation and running station businesses. By setting up adjustable charging approach via associated contract terms, both parties were able to reach agreement and enter into execution phase.

All participants agreed that in order to sustain a viable PPP in China, the government is required to share or retain more risks. The government needs to take on risks in relation to legislative, policy and regulatory change. The government is also recommended to take on or share risks associated with obtaining the approvals as they are better positioned to cope with the bureaucratic process required by various government departments. With regard to the demand and revenue risks, the government is suggested to share the risks with the private sector partner in order to ensure the economic viability of the intended project. It is especially the case when demands and the private sector's revenues are largely dependent upon the government's regulation (e.g., the regulated fare of metro lines, water pricing).

5 Comparative Analysis of Case Studies

An investigation of New Zealand and China's PPP practices finds that legal constraints exist in both countries, impeding the adoption and smooth execution of PPPs. New Zealand's current legal system generally allows the adoption of PPPs after a decade of debate on whether or not PPPs are suitable delivery models. Having witnessed the PPP development in countries such as the UK, Australia and Canada, the New Zealand government has included the PPP option in the pool of public sector procurement models and clearly indicated that a PPP will proceed as long as the value for money outcome is justified. By contrast, in China, the legitimacy of the government to enter into PPP contracts relies on enabling legislation, which in its current state, incomplete and fragmented. The involvement of private sector in long-term management and operation of public assets and private investment are restricted to specific infrastructure sectors or certain types of forms. The fragmented nature of PPP legislation in China is partly attributed to the fragmented PPP practices at different government levels, featured by three waves of PPP development in the 1980s, early 2000s and post-2005 after the release of *Opinion of the State Council* (Chen and Wang, 2009).

New Zealand's legal constraints for PPPs are mainly reflected in the procedural impediments and land acquisition restrictions imposed by Resource Management Act and Public Words Act. The indirect constraints for PPPs are partly originated in New Zealand's special historical events such as colonisation and the development of legal document – Treaty of Waitangi. In comparison, China's indirect legal restrictions on PPPs are multi-faceted, ranging from insufficient protection of property rights and potential risks of appropriateness, limitations on private asset and land ownership, prohibitions on land exploitation to impediments for obtaining approvals by the private sector. These legal constraints, to some extent, are due to the Chinese government's concern for wider public's interests. The lack of a mature PPP market, unclear criteria

for the selection of PPP models and inexperienced public procuring authorities may also be responsible for the indirect legal constraints for PPPs.

Inconsistent legislative provisions in relation to the permission of private sector involvement as a result of the change of government increase the risk of bidding for New Zealand's PPP projects, affecting the prospective private investors' interests in entry into New Zealand's PPP market. In China, the inconsistencies in legal framework surrounding the use of PPPs are primarily caused by the institutional arrangements for public sector procurement and the ambiguous role of governments (both as regulator and contracting party). Lacking of a coordinated approach towards the infrastructure planning and capital asset management and a thorough legal document specific to PPPs, various governments generally undertake infrastructure investment and development on an individual basis and therefore initiate a PPP for different reasons (mostly likely financing). The diversified government tend to establish policies or statues to accommodate the conditions of a specific project. The legal framework governing the execution of PPPs is therefore likely to vary between different governments or government departments, creating obstacles for the potential private investors to understand China's policy intent and directions of PPP.

6 Recommendations

With regard to the identified constraints, participants from New Zealand and China recommended associated remedies. A dedicated and experienced public procuring team with strong leadership is believed to be critical for ensuring that appropriate actions can be taken in face of emerging legal constraints. Involving government officials at different layers of the governance structure contributes to facilitating informed and prompt decisions to be made in a timely manner. Compared to New Zealand where a central PPP unit was set up within the Treasury to oversee and assist with PPP development, the PPP execution in China poses higher requirement on the public sector's capacity. As a developing country, China's first generation of PPP projects gained considerable supports from multi-lateral organisations such as World Bank and Asia Development, playing a leading role in scrutinising the PPP options and structuring the PPP transaction (Chen, 2009). However, in the absence of such organisations, China needs to develop its own capacity and skills in selecting and running PPP projects.

In addition to the requirement of capacity building, both New Zealand and Chinese government are suggested to take on more risks in PPP transaction. For both countries in which PPP markets remain relatively immature and lack of a required level of sophistication, the governments must be aware of, acknowledge and share or take on risks that are not best managed by the private sector. Risks that are related to legislative and regulatory change, or influenced by legal constraints should be retained by the governments.

New Zealand's attempts to promote a consistent and clear approach towards PPP selection and implementation have positive effects on the execution of the two pilot projects. The *Better Business Cases for Capital Proposals Toolkit* and the *Standard Contract* are perceived useful and effective in guiding the PPP practitioners. Consistent

application and continuous updates are necessary to capture the emerging trend of PPP development. In China, there has been a call for issuing a specific legal document dealing with PPPs, yet this is not conclusive. It would be of great benefit to have the document available and keep it updated as the experiences of PPPs grow. It is also important for the Chinese government to institute a well-established capital asset framework in which the criteria for PPP selection are clearly specified.

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Standardisation of the Conditions of Contract in the Building and Civil Engineering Construction Industry in South Africa

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Abstract:
The purpose of the study was to identify problems encountered as a result of using different types of conditions of contract in South Africa. The four types of conditions of contract recommended for use in the country are the NEC, JBCC, GCC and FIDIC. A literature review of publications on the subjects related to contractual disputes, the different conditions of contract used in South Africa, the CIDB and the challenges faced by contractors in South Africa was done. Interviews were conducted and questionnaires were also distributed to contractors, consultants, employers and other role players in the construction industry. Responses were received and analysed and the conclusion was that the current situation of using different types of conditions of contract is causing problems to role players and thereby affecting the growth and development of the industry and the economy of the country. It is therefore recommended that there should be one standard document of conditions of contract used for building and engineering contracts in the country.

Keywords:
Built Environment, Civil Engineering, Conditions of Contracts, Construction Contracts.

1. Introduction

The construction industry plays a major role in the economy and social development in South Africa. It provides the much need employment and physical infrastructure in the country. According to the Construction Industry Development Board (CIDB) (2012), which is a government body mandated to oversee the development of the construction industry, the legacy of apartheid has left the South African construction industry with a number of development and transformation challenges.

These include:

- Improving effectiveness of the public sector spending on physical infrastructure development and maintenance.
- Improving labour absorption, labour relations and job stability.

- Accelerating sustainable transformation through access to opportunity, finance and training.
- Reducing the impact of HIV and AIDS in construction
- Ensuring international competitiveness.

Part of the mandate of the CIDB is to support contractor development and emerging sector participation with more emphasis on the development of the previously disadvantaged contractors, by:

- Establishing an enabling environment for contractor development.
- Enhancing and strengthening contractor development mechanisms, including emerging contractor development programmes (ECDP's), joint ventures (JVs) and other appropriate mechanisms.
- Facilitating performance improvement of contractors.
- Supporting the creation of a pool of skilled artisans, supervisors, technicians and technologists for the construction industry (CIDB 2012).

In order for the construction industry in South Africa to fulfil its desired goal of development, there are certain challenges which have to be overcome. One of the major challenges is the use of different documents for conditions of contract, which result in challenges of disputes and inefficiency caused by lack of understanding of the terms and conditions. There are four types of conditions of contract recommended for use in South Africa. These are the New Engineering Contract (NEC), International Federation of Consulting Engineers (FIDIC – Conditions of Contract for Construction), General Conditions of Contract for Construction Works (GCC), and the Joint Building Contracts Committee (JBCC 2000) (Maritz and Schutte 2007).

2. Emerging Contractors

South Africa was ruled under apartheid from 1948 until 1994 when the country had its first democratic elections and a new democratic government came into power. People that were affected by the apartheid rule prior to 1994, being the less fortunate and least contributors in the countries' economy, are referred to in the new Constitution of the Republic of South Africa as Historically Disadvantaged Persons (HDP), and these racial groups generally comprise of Africans, Coloureds, Indians and Chinese.

The post apartheid transformation of the South African society was coupled with the economic transformation which resulted in emerging companies owned by the HDPs increasingly engaging in the formal economy (Martin and Root 2010, p.64). The construction industry, like in any other industry within the economy was also affected by the situation of an increasing number of new entrants into the industry. These new entrants are referred to as emerging contractors. The emergence of new contractors in the industry is associated with a number of challenges such as inadequate construction knowledge and lack of experience which tends to lead to limiting their growth (Martin and Root 2010, p.64). The South African government is fostering growth and development of entrepreneurs by creating an enabling environment for them to enter into the mainstream economy. This is done through various policies and institutions with specific mandates.

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3. Problems Faced by Emerging Contractors

The South African construction industry is in the developing phase where there is a huge influx of emerging contractors entering the industry. The government, through the CIDB, the National and Provincial Public Works departments and other concerned government institutions are trying to address and manage the challenges faced by this introduction of new role players in the industry but however, much still needs to be done. According to the Member of Executive Council for Gauteng Province, Mr. Humphrey M.Z. Mmemezi:

> "The boom in the construction industry has mostly benefitted big companies at the expense of emerging contractors, who were struggling to grow due to various reasons in the sector, despite the boom in the industry that was brought about by the FIFA Soccer World Cup, through refurbishment of stadiums and the construction of new ones (Mmemezi, 2010)."

The introduction of the emerging contractors with CIDB grading of 2 to 6 GB and CE into the construction industry is associated with a number of challenges as access to finance, technical expertise and contracts administration, to name a few. The challenge of contracts administration is made worse by the following factors:

- The contractors enter into contracts with little or no knowledge of the type of conditions of contract in use and have to learn the contract on the job, which poses a risk.

- There are various types of conditions of contract recommended for use in South Africa, which puts even more pressure on the already overburden contractors to learn and mater then all.

The need for small and medium construction companies in the country's economy is evident. Small and medium companies have a potential for addressing the problem of unemployment and creating a sustainable economy, but however, emerging contractors still remain unsustainable and this can be attributed to the shortcomings of the current development opportunities which lack continuity and necessary planning (Lazarus 2005, p.18).

Small and medium contractors are also frustrated by problems beyond their control such as the reluctance by finance institutions to increase their risk appetite in as far as lending finance (Mmemezi 2010).

> "Many strategies for emerging contractor development that are based on instruments such as targeted procurement, have generally failed to empower emerging contractors because they are implemented without well-defined skills transfer frameworks. The sector continues to be regarded by construction clients and suppliers as a high commercial risk and this presents further barriers to meaningful participation. Related to this is the lack of clear policy targets against which to measure the effectiveness of contractor support programmes (Lazarus 2005, p.4)".

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4. The Construction Industry Development Board

The Construction Industry Development Board (CIDB) is public entity established in 2000 with a mandate of promoting a regulatory and developmental framework that builds the construction delivery capability for South Africa's social and economic growth and also building a proudly South African construction industry that delivers to globally competitive standards (CIDB 2012). Part of the mandate of the CIDB is to regulate the construction industry in the whole country and also to support contractor development and the participation of emerging contractors. In order to achieve its mandate, the CIDB has implemented a grading system as illustrated in Table 1 below. The registered contractors are graded according to their type expertise, level of experience and availability of resources to complete different sizes and types of contracts. The CIDB has also entered into partnership with the National and Provincial Public Works Departments to form and implement the National Contractor Development Programme (NCDP), which is aimed at developing emerging contractors (CIDB 2012).

Table 1 shows the CIDB contractor grading system.

Table 1. The CIDB contractor grading system
(Source: CIDB 2012)

Works Capability		**Contractor Grading**				
Designation	**Maximum (ZAR) value of contracts that a contractor is considered capable of performing**	**General Building (GB)**	**Civil Engineering (CE)**	**Electrical Engineering (EB & EP)**	**Mechanical Engineering (ME)**	**Specialist Works (SP)**
1	200 000	X	X	X	X	X
2	650 000	X	X	X	X	X
3	2 000 000	X	X	X	X	X
4	4 000 000	X	X	X	X	X
5	6 500 000	X	X	X	X	X
6	13 000 000	X	X	X	X	X
7	40 000 000	X	X	X	X	X
8	130 000 000	X	X	X	X	X
9	No limit	X	X	X	X	X

The largest percentage of the total number of registrations with the CIDB consists of small and medium contractors of Grades 2 to 4 in General Building (GB) and Civil Engineering (CE) for the whole country. Tables 2a and 2b show the distribution of registration of contractors in the whole country from Grades 2 to 9. Overall, it is seen that the number of registrations in Grades 2 to 4 account for around 60% to 70% of the total registrations in Grades 2 to 9, whereas the number of registrations in Grades 7 to 9 account for around 8% of the total number of registrations (CIDB 2012, p.18).

From the above analysis it is evident that the larger percentage of the country's registered contractors consists of the small and medium contractors.

Table 2a. Supply registrations per Grade – General Building (GB)
(Source: CIDB 2012)

Contractor Grading (GB)	Number of Contractors	% Distribution
9	29	1%
7 & 8	305	6%
5 & 6	1284	24%
2 & 4	3700	70%
Total	**5318**	**100%**

Table 2b. Supply registrations per Grade – Civil Engineering (CE)
(Source: CIDB 2012)

Contractor Grading (CE)	Number of Contractors	% Distribution
9	43	1%
7 & 8	322	7%
5 & 6	1439	30%
2 & 4	3012	64%
Total	**4816**	**100%**

5. Conditions of Contract

The conditions of contract play a vital role in defining the roles and responsibilities of the parties in a contract. They serve as a guideline to define the expectations and obligations of each party in order to eliminate the risk of failure by the parties or disputes in the contract. It is of vital importance that both parties in a contract understand the terms and conditions of the contract as the contract determines the success or failure of the project.

(Finsen 1991, p.1) defines a contract as "an agreement between two or more persons which gives rise to personal rights and corresponding obligations. It is an agreement which is legally binding on the parties". The two parties in a contract bind themselves to an agreement. The contractor agrees to construct the structure for the agreed amount and the employer agrees to pay.

There is no clear guideline governing the choice of specific types of conditions of contract in the industry. Usually the common practice is that the employer alone or through the advice of his/her technical team will decide on the type that they prefer and understand better or one that they find suitable for the project with less or no consideration at all of the other party in the contract, the contractor. This situation leads to frustration amongst the contractor, technical team and sometimes even the employer as more time is spent in having to learn the contract instead of executing the project. This can further affect the ability of the contractor, members of the technical team and even the employer, to execute their responsibilities effectively and efficiently and therefore resulting in contractual disputes and project failure.

The industries preference of the conditions of contract is clearly illustrated in the quarterly report of the CIDB, "Construction Industry Indicators". The study of the distribution per project and employer category as illustrated in Table 3 shows that the largest group of responses received were from civil works (43%) and non-residential building projects (26%). Projects of the private sector (24%), provincial departments (18%) and metropolitan councils (35%) were best represented in the survey (CIDB 2012).

Table 3. Agent survey response distribution per project type and employer category 2010 (Source: CIDB 2012)

Project Type	**Total No. Of projects**	**24**	**11**	**6**	**18**	**35**	**5**	**1**	**0**	**% of Total Survey Results**
Residential Building	29	17	1	0	2	4	1	4	0	5%
Non-residential Building	145	37	17	10	65	12	2	2	0	26%
Civil Works	237	38	19	15	26	121	17	1	0	43%
Mechanical Works	16	4	1	2	0	7	1	1	0	3%
Electrical Works	100	28	22	5	6	38	1	0	0	18%
Special Works	28	7	2	1	2	13	3	0	0	5%
Not Specified	0	0	0	0	0	0	0	0	0	0%
Total No. Of Projects	555	131	62	33	101	195	25	8	0	
Employer Category		**Private Sector**	**Public Corporation e.g. ESKOM, ACSA**	**National Department**	**Provincial Department**	**Metropolitan Council**	**Regional / District Council**	**Public Private Partnership**	**Not Specified**	

A similar study of the type of contract document used for different project types in the year 2010 as shown in Table 4, shows that the JBCC form of contract was most popular for residential (69%) and non-residential (70%) building projects as well as for special works contracts (57%). The GCC form of contract was most popular for civil works (82%) and mechanical works (60%) contracts. For electrical works the GCC (27%), NEC (23%) and JBCC (25%) were all popular forms of contract. The GCC (60%) and FIDIC (26%) forms of contract were mostly used for mechanical work contracts. The study also shows that it was necessary to significantly amend the contracts to suit particular needs, especially when the NEC (36%) and FIDIC (39%) forms of contract were used. These were mainly used for mechanical and electrical works projects (CIDB 2012).

Table 4. Type of contract document used for different project types in 2010
(Source: CIDB 2012)

Project Type	**% Contract Document Type usage for each Project Type**					**Total**
Residential Building	21	0	69	0	10	100
Non-residential Building	8	4	70	1	17	100
Civil Works	82	3	2	9	4	100
Mechanical Works	60	0	7	26	7	100
Electrical Works	27	23	25	17	8	100
Special Works	28	4	57	7	4	100
Contract Document Type	**GCC**	**NEC**	**JBCC**	**FIDIC**	**OTHER**	
% Projects with Contract Document significantly amended	22	36	18	39	6	

6. Contractual Disputes

Disputes are common in the construction industry. One of the main reasons for entering into a formal agreement with clearly defined term and conditions is to reduce or eliminate the risk of disputes. It is important for both parties in a contract to have a clear understanding of the conditions of contract that bind them in order to execute their duties and responsibilities without infringing into the rights of the other party.

Construction risks need to be identified and mitigated as early as possible, preferably at tender stage or contract signing stage. Failure to do so may pose a risk of possible disputes in the near future. Constructions disputes can be costly if not attended in a timely manner as valuable resources and time can be spend dealing with the dispute which may also result in causing delays in the completion date (American Bar 2012).

According to Mills (2006) the eruption of disputes on a construction site is usually as a result of several factors, including;

- A culture of under-competitive tendering, with contractors ready to tender, claim high;
- A project team assembled ad hoc without considering whether the team can work together;
- The function of the contract administrator, whose position as an independent certifying officer is considered at variance with being in the pay of the employer; and
- Poorly drafted contracts

From a South African perspective, one of the biggest risks that lead to contractual disputes is as a result of contractors commencing the construction works without proper contract documentation.

> "Contractors in South Africa often commence with construction following instructions contained in a letter of intent, also known as the memorandum of understanding in the mistaken belief that the letter of intent is equivalent to a letter of acceptance or employer's award (Muller and Welcome 2008)."

The letter of intent does not represent the employer's acceptance of the offer and the contractor has a right to not sign the contract agreement should he/she decide not to sign, the reason being that, according the South African law a contract only exists once the offer has been accepted and there is no contract prior to acceptance (Muller and Welcome 2008).

7. Objectives of the Study

The objective of the study is to establish the opinions and perceptions of the various stakeholders in the building and construction industry in South Africa in relation to the relationships and risks associated with the use of different types of conditions of contract.

8. Research Methodology

The research methodology included literature review of local and international publications on the subjects of contract disputes, the different conditions of contract used in South Africa, the CIDB and the challenges faced by contractors in South Africa. Two questionnaires were circulated around the different role players in the construction industry in Bloemfontein. The use of questionnaires was influenced by the following reasons:

- Time and budget constraints – it was more cost effective and quicker to reach the number of people sampled through questionnaires.

Interviews were also conducted with a small number of selected role players for the following reasons:

- A limited sample of senior project managers from various employers around Bloemfontein could be reached.
- The interviews also provided more flexibility to optimise the gathering of information.

8.1 Sample

The sample for questionnaires consisted of various stakeholders in the building and construction industry around Bloemfontein city of the Free State province and questionnaires were distributed as follows:

- Fifteen questionnaires were distributed to contractors,
- Eight questionnaires to consultants,
- Four questionnaires to employers and
- Four questionnaires to other individuals actively involved within the construction industry.

A 75% response rate was received.

Interviews were conducted with three officials from the project management departments of the each of the major employers in the Free State Province being the Mangaung Metropolitan Municipality and the National and Provincial Departments of Public Works. Three local contractors were also interviewed.

8.2 Research Methods

8.2.1 Interviews

The interviews comprised questions on the interviewees experience, their challenged in carrying out their day-to-day project management and construction duties, their level of understanding of the type of conditions of contract that they frequently use in their projects and also to establish whether they could easily switch from one form of conditions of contract to another without difficulty. The interviewees indicated their different views on their challenges and desired improvements on the types of general conditions of contracts to be used in South Africa.

8.2.2 Questionnaires

Two questionnaires targeting different groups were distributed. The first questionnaire was designed for contractors with the aim of establishing their various roles in the construction industry, the type of conditions of contract they have used in the past five years, their challenges with understanding the terms and conditions of their contract resulting in disputes, financial losses and finally, the conditions affecting their ability to execute their duties effectively. The second questionnaire was designed for the other group of role players such as professional consultants, employers and other professions involved in the construction industry. The respondents indicated their challenges and desired changes in construction contract. All participants were assured that their participation was voluntary and the information they provide would be treated confidentially.

8.3 Data Analysis

Microsoft® Office Excel® 2007 was used for data analysis with tables and graphs.

9. Findings

9.1 Interviews

The interviews conducted with the officials of the three main employers and contractors in the province show the following:

- The government makes use of a modified JBCC 2000 contract predominantly for building contracts and mostly the GCC for engineering contracts.
- Contractors do not always have a say in the choice of the form of conditions of contract for their contracts with the government.

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- There is a common risk of small contractors within the CIDB Grades 1 to 4 in General Building (GB) and Civil Engineering (CE) of not meeting their contractual obligations as a result of them not understanding the contract well enough, which at time leads to contractors suffering losses due to penalties and delays.

- Small contractors are often disadvantaged in contracts as a result of them not being aware of their contractual rights and obligations.

- Employer/Client relations are often compromised as a result of contractual disputes which could be avoided.

9.2 Questionnaires

Twenty four questionnaires were completed and returned out of thirty one questionnaires that were distributed. Fourteen questionnaires were returned from consultants, employers and others and ten questionnaires were returned from contractors.

The data as illustrated in Table 5 indicates that the JBCC and GCC contracts were the most popular contracts used by the respondents in the past five years with each one used twelve times, which constitutes thirty eight percent (38%) each, the NEC is the second highest with nineteen (19%) and FIDIC is the lowest with six percent (6%).

Table 5 shows the distribution of the conditions of contracts used in the past five years.

Table 5. Contract document used in the past five years

Conditions of Contract Used	**Contracts used in the past 5 years**	**Percentage of usage**
JBCC	12	38%
NEC	6	19%
GCC	12	38%
FIDIC	2	6%
TOTAL	**32**	**100%**

The data as illustrated in Table 6 shows that of the four types of contracts used, the users understand the JBCC contract the most, followed by the GCC and NEC with FIDIC being the least understood.

Table 6. Level of understanding of the contracts used in the past five years

	LEVEL OF UNDERSTANDING		
Conditions of Contract	**High**	**Moderate**	**Low**

JBCC	6	9	2
NEC	2	4	3
GCC	2	6	2
FIDIC	1	1	2

Table 7 illustrates the challenges of the respondents and their desired changes. Thirty eight percent (38%) of the respondents have suffered a financial loss as a result of their lack of understanding of the conditions of contract. Fifty eight percent (58%) have had disputes in their previous contracts as a result of their lack of understanding of the conditions of contract. Sixty three percent (63%) recommend that the South African construction industry should make use of one form of contract document. Forty two percent (42%) believe that changing of the conditions of contract that they are familiar with can affect their ability to execute their duties effectively and over fifty percent (50%) say that using one form of contract for construction contracting in the country can improve efficiency, the use of different conditions of contracts discourages the government's efforts to train and develop small contractors and to address the imbalances in the industry. They also believe that the current system does not give the contractor mush say in the choice of the type of contract to be used.

Table 7. Challenges and desired changes

Question	**Answer**		**Percentage %**
	Yes	**No**	**Yes**
Have you suffered a financial loss as a result of lack of understanding of the conditions of contract?	9	15	38%
Disputes as a result of lack of understanding of the conditions of contract?	14	10	58%
Do you recommend the use of one form of conditions of contract in South Africa?	15	9	63%
Can changing of the conditions of contract affect your ability to execute your duties effectively?	10	14	42%
Can having one form of conditions of contract improve efficiency in the industry?	14	10	58%
Does the use of different conditions of contracts discourage the government's efforts to train and improve emerging contractors?	14	10	58%
Does the use of different forms of conditions of contracts discourage the government's efforts to correct the imbalances within the industry?	13	11	54%
Does the current system favour the employer over the contractor in the choice of the form of contract?	12	12	50%

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10.Conclusions

According to the literature review and research findings, construction contracts play an important role in defining the roles and responsibilities of parties in an agreement and also in eliminating the risk of disputes and failure, therefore both parties should be able to understand the terms and conditions of the contract in order for the contract to achieve its intended purpose.

The use of different types of conditions of contract is creating problems for the intended users especially the small and emerging contractors who lack experience and resources to hire experts for their contracts administration. This problem does not only affect small contractors, but it also affects the other role players such as the consultants, who also go through the same trouble of having to learn and understand all types of contracts in use. This situation also has a potential to hamper the development of the construction industry and the economy of the country as it hampers the growth of small and medium employers.

11.Recommendations

There is a need for a concerted effort by all role players in the construction industry in South Africa to design one standard document of conditions of contract that can be used for both building and engineering contracts. This can be achieved by modifying the existing contracts to suit the local conditions and also to meet the requirements of the industry. The CIDB should also play a leading role is brining all concerned parties together and also regulating the construction procurement documentation for both government and private contracts.

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AN ASSESSMENT OF THE ADOPTION OF PARTNERING IN THE NIGERIAN CONSTRUCTION INDUSTRY

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ABSTRACT

Cooperative orientation among members of Construction Supply Chain (CSC) remains important to successful management of construction projects. However, in most developing economies of Africa the traditional adversarial system of construction procurement is yet to be fully substituted by the cooperative orientation of partnering. This paper investigates the level of adoption of partnering in Nigerian Construction Industry (NCI). Data on partnering adoption were obtained from project participants with the aid of structured questionnaire. The result indicates that only few out of the firms surveyed claim they have some form of partnering arrangement with their top suppliers/subcontractors. The study finds that the most important challenges to successful partnering are partner selection, communication gap and informal arrangement. Other challenges include trust, sharing of risk and reward, commitment and conflicts of interest etc. The study concludes that partnering remain at its infancy in the NCI. The study recommends for a clear partners selection and alliancing guidelines, efficient communication, proper sharing of risk and reward, commitment to CSC objectives, involvement from inception, legal backing and construction code of practice backing for a successful adoption of partnering in Nigeria.

Keywords: alliancing, construction supply chain, Nigerian construction industry, partnering, procurement, subcontractors, trust.

INTRODUCTION

The continual tension brought about by competitive procurement in the Construction Industry (CI) has created a culture akin to the 'law of the jungle', leading to communication gap and deficit of trust, poor relationships, adversarial attitudes and disputes among construction stakeholders (Stehbens, et al., 1999). In a move to change this situation the Latham (1994) and Egan (1998) reports on the UK Construction Industry (UKCI) and the Movement for Innovation (M4I) (2000) advocates the use of partnering , stressing that smooth relationships based on mutual trust benefit stakeholders

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by improving project performance. Partnering has worked in the CI of several countries (Matthews, 1999) including the UK (Green, 1999), Hong Kong (Chan *et al*., 2004) and South Africa (Allen *et al*., 1999) Japan (Reading Construction Forum, 1998) Australia (Stehbens, et al., 1999). However, partnering is not widely practiced in developing countries due to low awareness and skepticism about its workability and benefit (Ng, 1997). In Nigeria the concept of partnering is new; awareness is low and the potential benefits not yet understood or explored by stakeholders. The study aims at investigating the level of application of partnering in the Nigerian Construction Industry (NCI).

LITERATURE REVIEW

Partnering can be defined by:(i) its 'attributes', such as trust, shared vision and long term commitments; and (ii) the 'process', including developing a mission statement, agreeing on goals, organizing and conducting workshops (Crowley and Karim, 1995 and Matthews, 1999). The concept of partnering emerged in the mid-1980s (Hancher, 1989) although partnering between contractors and private clients is not new (Godfrey, 1996). Partnering stresses the importance of developing a synergy of a 'win/win' relationships and forging trust based on principles of mutual trust, respect, commitment, cooperation, open communication and excellence for all stakeholders towards facilitating greater collaboration to the achievement of project objectives (Latham, 1994, Barlow, et al., 1997, Fellows, 1997, Scott 2001). Trust and teamwork prevent disputes and foster a cooperative bond among stakeholders. Generally trust is seen as the cornerstone of a successful partnering and improving procurement and contractual relations in the CI (Latham, 1994 and Hellard, 1995).

Through personal relationships and communication among stakeholder, risks and goals are better understood leading to trust and possibly a synergistic relationship (Fellows, 1997, Lau, 1999). Partnering encourages parties to re-design their business processes to facilitate improvements in the exchange of information, development of closer cooperative relationships and ultimately, mutually beneficial project collaboration through trust (Wong and Cheung, 2004). Partnering may be short-term and project-orientated or long-term and strategic in nature (Barlow and Jashaparar, 2000). In the latter case the partnering is typically concerned with optimising the partnership's resources through closer collaboration to maximise long-term benefits, whilst in the former, emphasis is more likely to be on agreeing on project governance issues to secure immediate project benefits rather than on developing advanced cooperative practices (Beach, et al., 2005).

More recently further advancement to partnering termed Alliancing has been successfully utilized in the CI. Besides including key factors contained in partnering, alliancing adds a clearly defined risk allocation with gain/pain share to manage the process. Alliancing is "where the arrangement is underpinned by an incentive scheme, whereby the rewards of the contractor and indeed, the owner are linked directly to actual performance during the execution phase of the project" (Scott, 2001).Parties contractually commit to their contribution levels and required profit and then place these at risk in undertaking the project. This provides incentive to achieve project goals (Walker and Hampson, 2003). Alliancing thus provide a legal base for partnering as a contractual requirement and uses clearly defined risk allocation with incentives to manage the process (Tang, et al. 2006).

There are five types of alliancing: *Transactional Relationship:* no formalized relationship; each transaction is made independently at arms length ; *Basic Alliance:* tactical relationship designed to establish basic level of trust and honest, open communication; *Operational Alliance:* frequent communication regarding capacity and demand with joint problem solving; *Business Alliance:* greater mutual dependence with specialized processes & unique products and services; And *Strategic Alliance:* long term trusting relationship involving shared commitment/resources that deals with strategic issues (Mentzer, et al., 2000)

Benefits of Partnering/Alliancing

Partnering lead to- improved ability to respond to changing project environment; improved quality and safety; reduced project cost and time; improved profit and value; and improve efficiency of resources utilization (McGeorge and Palmer, 1997). Partnering significantly result in ; expeditious work processes; elimination of redundant work; minimisation of surprises; cost savings for clients and profits for contractors; better time, quality and safety performance; reduce claims and variations; and reduced exposure to disputes and litigation(Matthews, 1999, Graijek, et al. 2000, Li *et al*. 2000, Prahalad and Hamel, 1990, Anumba et al. 2000b). Additionally, partnering offers opportunity for participants to develop a working atmosphere conducive for innovation, teamwork, trust and commitment (CII, 1991). Through partnering best practice such as Supply Chain Management (SCM), Total Quality Management (TQM) and Risk Management etc can be successfully transferred from the Manufacturing Industry to the CI (Anumba, et al. 2000a, Ngowi, 2000, Tang, et al. 2006). Partnering is effective in developing competitiveness (Errasti, et al., 2007). Similarly, alliancing like partnering significantly improve cost and time performance of construction projects (Ross, 2001, Voordijk, 2000, Clegg, 2001, Scott, 2001, Gallagher, 2002 and Olds, 2002). A comparative assessment of the performance of partnering and alliancing projects indicates that both partnering and alliancing reduce the incidences of cost and time overruns but alliancing have a greater impact on project cost than partnering (Tang, et al., 2006).

METHODOLOGY

Research Design; the study adopts a survey research design, which is a structured mean of collecting data on certain variables of interest from a representative proportion of the population. Survey may be use for exploratory, descriptive or correlational studies. Surveys remain very popular in research because they enable a research to quickly obtain quantitative and qualitative data on variables of interest from a proportion of a given population. The possibility of studying a sample of the population is a major advantage because of the savings in cost and time.

Sampling; the study involve the five subgroups of participants in the CI – which includes consultants, contractors, subcontractors, suppliers and plant hiring organizations. A sample size of 100 firms was adopted for the study. Purposive and convenience sampling approach were used to reach the respondents. The questionnaires were hand delivered to the respondents for filling and later collected through the same means. A total of 50 (50%) questionnaires were returned by the close of the survey , however, one of the questionnaires were not use due to error , hence, the total sample size is 49.

Method; the study used structured questionnaires which are divided into four sections. The questionnaire is composed of structured questions with various options to choose from i.e. closed form items and limited open questions. The study faced difficulties sourcing information via questionnaires from most construction firms' officials. This may be due to the relative newness of the concept of partnering and alliancing in the NCI.
Analysis; Descriptive statistical analysis of completed questionnaires was carried out including measurement of central tendency and frequency.

RESULT

Relationship with Top five suppliers / subcontracting firms

*Relationship with the largest Firm;*The result shows the type of relationship between construction firms and their topmost customers, 12.2% maintain a full partnership , 16.3% have some form of partnership arrangement , 40.8% were undecided while 30.6% said they have Traditional relationships with their number first customer.
Relationship with the Second Largest Firm ; For the type of relationship with the second largest customer, 6.1% of the firms held that they have full partnerships , 14.3% of the firms held that they have some forms of partnership , 59.2% are undecided while 20.4% have Traditional relationships with their second largest customer.
Relationship with the third Largest Firm ; For the third largest customer, 4.1% of the firm have a full scale partnership , 20.4% have some form of partnership , 61.2% are undecided and 14.3% claimed they Traditional relationship with third largest customer.
Relationship with the fourth Largest Firm ; for the fourth largest customer only 2% of the firms maintain full partnership, 20.4% have some of partnerships, 65.3% are undecided 12.2% claimed they have Traditional relationship with fourth largest customers.
Relationship with the fifth Largest Firm ; For the fifth customer just 2% have full partnership, 24.5% maintained some form of relationship, 59.2% are undecided and 14.3% have Traditional relationship with fifth largest customer (see table 1).

Table 1 Relationship with top most firms

Type of relationship	Largest firm	Second largest	Third largest	Fourth largest	Fifth largest
	Percent	Percent	Percent	Percent	Percent
Full partner	12.2	6.1	4.1	2.0	2.0
Partner	16.3	14.3	20.4	20.4	24.5
Undecided	40.8	59.2	61.2	65.3	59.2
Traditional	30.6	20.4	14.3	12.2	14.3
Total	100.0	100.0	100.0	100.0	100.0

Types of Supply Chain Alliancing

Consultant; Among the consultants surveyed 6.1% use strategic alliance, 10.2 used business alliance, 28.6% use operational alliance, 24.5% use basic alliance and 12.2% use the transactional alliance.

Contractors; Among the contractors surveyed 6.1% use strategic alliance, 30.6% used business alliance, 34.7% use operational alliance, 6.1% use basic alliance and 2% use the transactional alliance.

Sub Contractor; for the sub contractors surveyed no strategic alliance, 10.2% used business alliance, 42.9% use operational alliance, 10.2% use basic alliance and 16.3% use the transactional alliance.

Suppliers; Among the suppliers surveyed no use strategic alliance was recorded, 22.4% used business alliance, 30.6% use operational alliance, 22.4% use basic alliance and 4.1% use the transactional alliance.

Hiring Company; Among the hiring companies surveyed no strategic or business alliance was recorded , however, 16.3% use operational alliance , 20.4% use basic alliance and 42.9% use the transactional alliance(see tabel 2).

Table 2 level of usage of the types of supply chain alliancing

Types of alliancing	Consultant	Contractor	Subcontractors	Supplier	Plant hirer
	Percent	Percent	Percent	Percent	Percent
Strategic alliancing	6.1	6.1	-	-	-
Business alliancing	10.2	30.6	10.2	22.4	-
Operational alliancing	28.6	34.7	42.9	30.6	16.3
Basic alliancing	24.5	6.1	10.2	22.4	20.4
Transactional alliancing	12.2	2.0	16.3	4.1	42.9
Total	81.6	79.6	79.6	79.6	79.6
System	18.4	20.4	20.4	20.4	20.4
Total	100.0	100.0	100.0	100.0	100.0

*Benefits of Strategic Supply Chain Partnering ;*An assessment of the benefits derivable from alliance show that respondents rated quality improvement as the most important benefit M=4.47, followed by technology development M= 4.33, then risk shearing M=3.88 surprisingly reduction of material cost was rated the least M=3.53(see table 3).

Table 3 benefits of strategic supply chain Partnering

Benefits of partnering	Mean(M)	Rank
Quality improvement	4.47	1
Technology development	4.33	2
Risk shearing	3.88	3
Meeting production time	3.8	4
Meeting market demand	3.69	5
Reduction in prod cost	3.53	6
Reduction in material cost	3.49	7

Challenges to Successful Supply Chain Partnering; As for the challenges involve in the implementation of a successful supply chain alliance respondents rated partner selection M= 6.4, communication gap M=6.14 and informal arrangement M= 6.1 as the most important.

Table 4 challenges to successful supply chain Partnering

Challenges of partnering	Mean(M)	Rank
Partner selection	6.4	1
Communication gap	6.14	2
Informal arrangement	6.1	3
Trust	5.82	4
Risk sharing	5.47	5

Reward sharing	5.29	6
Commitment	5.1	7
Conflict of interest	4.89	8
Legal framework	4.86	9

*Corrective Measures for Successful Supply Chain Partnering ;*On measures necessary for a successful partnering/alliancing, respondents rated clear partners selection guideline M=6.04, clear alliance guideline M=5.94, bridging communication gap M=5.92 as the most important. A pre-defined approach to shearing risks and rewards was rated fourth (M= 5.2). Commitment to supply chain objectives was fifth (M=4.8). Involvement from inception (M= 4.67); Legal backing (M=4.27) and code of practice (M=3.92) were rated least as sixth, seventh and eight respectively.

Table 5 corrective measures for partnering

Measures	mean	rank
Clear partners selection guideline	6.04	1
Clear partnering /alliance guidelines	5.94	2
Bridging communication gaps	5.92	3
Proper sharing of risk and reward	5.2	4
Commitment to supply chain objectives	4.8	5
Involvement from inception	4.67	6
Legal backing	4.27	7
Construction code of practice backing	3.92	8

DISCUSSION

Most of the highly rated challenges in this study such as communication gap, informal arrangement, trust, risk and reward sharing, commitment, conflict of interest and legal framework are supported in the body of literature. For example Harback *et al.* (1994) identify five challenges of partnering: unfulfilled expectations; unfinished business in which some elements of the partnering arrangement are still in dispute; assumption that all parties involved in the partnering are willing to share personal beliefs /thoughts; and adoption of a one-size-fits-all approach to all projects. Hellard (1995) also highlights the potential challenges such as: the perceive risks in trusting; commitment of top management; and difficulty in changing myopic thinking and cultures. Akintoye and Black (1999) identify five risk factors: managers' unwillingness to relinquish control; partners becoming complacent; increasing dependence on a partner; pressure to perform; and a partner reverting to adversarial relationship. Similarly, Begg, (2003) asserts that the CI guidance on partnering is vague on the legal implications of relational concepts when expressed in construction contracts. The lack of trust inhibits the sharing sensitive information. The unwillingness to share information is an attitudinal barrier that arises from long-standing tensions that has been perpetrated among Construction Supply Chain (CSC) members.

CONCLUSION

The adoption of the concept of Partnering/Alliancing is at its infancy and thus facing several challenges. Some of these challenges includes: - Partner selection; Communication gap; Informal arrangement; Trust; Risk and Reward sharing; Commitment; Conflict of interest and Legal framework. Therefore for a successful

partnering there are needs for Clear partners' selection guideline; Clear alliance guidelines; efficient communication; improved risks and reward sharing; Commitment to CSC objectives; Involvement from inception; Legal backing and Construction code of practice. A formal guideline comprising of policies and procedure to guide who potential partnering and alliancing arrangement, how resources will be shared and investment will take place have to be established. Formulating a clear partner selection guideline will help in determining who to work with on a collaborative, alliance basis; and who has the potential advantage over others.

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ANTICIPATING WHAT MAY GO WRONG: IMPLICATIONS FOR MANAGING SCHEDULE RISK

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ABSTRACT

The probability of schedule overruns on construction projects can be ascertained using a 'best fit' probability distribution from an empirical distribution. The statistical characteristics of schedule overruns occurring in 276 Australian construction and engineering projects were analysed. Skewness and kurtosis values reveal that schedule overruns are non-Gaussian. Theoretical probability distributions are then fitted to the schedule overrun data; including the Kolmogorov-Smirnov, Anderson-Darling and Chi-Squared non-parametric tests to determine the 'Goodness of Fit.' A Four Parameter Burr (4P) probability function best describes the behaviour of schedule overruns, provides the best overall distribution fit and is used to calculate the probability of their occurrence. Implications for managing schedule risk are discussed.

Keywords: Australia, schedule overrun, distribution fitting, probability distribution

INTRODUCTION

Client demands for early completion to minimize finance costs and increase return on investment to satisfy investors and stakeholders can lead to over optimistic schedules being produced (Kog et al., 1999). As a consequence, the likelihood of schedule overruns being experienced increases. According to the Building Cost Information Service of the Royal Institute of Chartered Surveyors, 48% of projects experience schedule overruns (Kennett, 2009). Schedule overruns can adversely influence the organizational performance and profitability of clients, contractors and key stakeholders. Schedule and cost overruns often arise simultaneously, albeit projects can experience a cost overrun and be delivered ahead of schedule or vice versa (Love, 2002). A plethora of reasons are proffered within the extant literature to justify schedule overruns that arise including change orders, rework, unforeseen ground conditions, and delays in design information (Chan and Kumaraswamy, 1997). Yet despite the accumulation of knowledge pertaining to the causal nature of schedule overruns, there has been limited research that quantifies their empirical and statistical distributions. In addressing this identified shortcoming, this paper uses data from 276

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Australian construction and engineering projects to determine the 'best fit' distribution to enable a realistic estimate of possible schedule overrun probabilities.

SCHEDULE OVERRUN

Schedule overruns are often referred to as 'delays', 'schedule growth' or 'time overruns'. A schedule overrun occurs when the original contract period specified at contract award is extended beyond what was agreed prior to the commencement of works on-site (Assaf and Al-Hejji, 2006). According to Bhargava et al. (2010) projects with longer planned durations experience higher cost overruns and similarly the converse is also true. Odeck's (2004) research, for example, demonstrated that larger cost overruns were experienced in smaller projects. Thus, it appears larger projects are better managed and that longer completion times provide an opportunity to make adjustments to facilitate better planning and scheduling to minimize delays that may be caused by factors such as inclement weather and change orders.

A study of 309 Australian construction projects undertaken by Bromilow (1969) revealed that 88% experienced a schedule overrun. Over forty years later, Ashan and Gunawan (2010) revealed almost identical findings and observed that 86% of development projects conducted experienced a schedule overrun. The amount by which a project experiences a schedule overrun was found to vary significantly. Assaf and Al-Hejji (2006) found that most contractors and consultants indicated that average schedule overruns range from 10% to 30% of original contract period. Ashan and Gunawan (2010) reported that the average schedule overrun was found to be 33.37%, though this varied between different countries. For example, the mean schedule overrun in Bangladesh was 34.41%, China, 13.63%, India 55.69%, and Thailand 32.71%. Projects experiencing a schedule underrun on average experienced a US$79 million cost underrun (19% of planned cost). Of the 86% of projects completed within budget or under budget, 29% experienced an average schedule overrun of 16 months.

RESEARCH APPROACH

The dataset presented in Love et al. (2009) for Australian construction and engineering projects is used to develop 'best fit' statistical distributions so that probabilities for cost overruns at contract award can be determined.

Questionnaire Survey

The questionnaire survey developed for the study reported in Love et al. (2009) was used to extract cost overrun information as well as that relating to rework costs and causes. Stratified random sampling was used to select the study sample from the telephone directory, Yellow Pages® for the various regions of Australia. Two main benefits can be derived from using a stratified sample: (1) It can ensure that adequate and representative respondents within each subgroup under study are acquired; (2) Stratification also ensures that respondents within the same group are homogeneous.

Before the sample size for the main study could be determined, a pilot survey was completed with 30 building and 20 civil engineering contractors. As the survey of building contractors was undertaken first, it was considered to be reliable, and then used to pilot the civil engineering sample. The firms sampled comprised of design and engineering consultants, project managers, and contractors. The rationale was to test the suitability, clarity, and comprehensibility of the questionnaire as well as measure the response rate. Participating firms were contacted by telephone and informed of the research aims and objectives and informed that all responses would remain strictly confidential; albeit, generalizations of the findings would be made available to all participants.

On participant consent, questionnaires were mailed to the sample, with a stamped addressed return envelope enclosed. Participants were invited to critically review the questionnaires' design and structure by annotating comments onto the document itself in order to provide constructive feedback. Comments received were positive and therefore the questionnaire remained largely unaltered for the main surveys; albeit a few minor layout changes were made to increase clarity. A total of 25 responses were received in the building project pilot survey, giving an 83% response rate. For the civil engineering project survey, a total of 17 responses were received, giving an 85% response rate. These high response rates were obtained because prior consent to support the work was obtained from all survey participants.

In the main survey, 420 and 300 questionnaires were distributed to design consultants, contractors and project managers for building and civil engineering projects, respectively. As there were no fundamental changes required to either of the pilot questionnaires they were added to the samples. For the building and civil engineering projects, 161 and 115 responses were received respectively, which represents a total consolidated response rate of 36% for both surveys, which is within an acceptable range for a survey with industry practitioners.

PROCEDURE

Descriptive statistics such as the mean (M), standard deviation (SD), and inter-quartile were calculated. A one-way Analysis of Variance (ANOVA) was used to determine if cost overruns significantly varied between construction and engineering projects and original contract value at a 0.05 significance level. Probability density functions were developed using *EastFit 5*. A PDF for a continuous distribution can be expressed in terms of an integral between two points:

$$\int_a^b f(x)dx = P(a \le X \le b) \qquad \text{[Eq.1]}$$

A cumulative distribution functions (CDF) was also produced. For theoretical continuous distributions the CDF is expressed as a curve and denoted by:

$$F(x) = \int_{-\infty}^{x} f(t)dt \qquad \text{[Eq.2]}$$

The empirical CDF, which is displayed as a stepped discontinuous line and dependent on the number of bins, is represented by:

$$F_n(x) = \frac{1}{n} \cdot [\text{Number of observations} \leq x] \quad \text{[Eq.3]}$$

The PDF, CDF and distribution parameters ($\alpha, \beta, \gamma, \mu, k, m, \sigma, \xi$) for continuous distributions such as *Beta*, *Burr*, *Cauchy*, *Error, Gumbel Max/Min*, *Johnson SB*, *Normal*, and *Wakeby* were examined using the estimation method Maximum Likelihood Estimates (MLE). Using StatAssist 5.5, the 'best fit' distribution was then determined using the following 'Goodness of Fit' tests, which measure the compatibility of a random sample with a theoretical probability distribution:

- *Kolmogorov-Smirnov statistic (D)*: Based on the largest vertical difference between the theoretical and empirical CDF:

$$D = \max_{1 \leq i \leq n} \left(F(x_i) - \frac{i-1}{n}, \frac{i}{n} - F(x_i) \right) \quad \text{[Eq.4]}$$

- *Anderson-Darling statistic (A^2)*: A general test to compare the fit of an observed CDF to an expected CDF. The test provides more weight to a distributions tails than the *Kolmogorov-Smirnov* test. The Anderson-Darling statistic is defined as:

$$A^2 = -n - \frac{1}{n} \sum_{i=1}^{n} (2i-1) \cdot \left[InF(x_i) + In\left(1 - F(x_{n-i+1})\right) \right] \quad \text{[Eq.5]}$$

- *Chi-squared statistic* (χ^2): Determines if a sample comes from a population with a specific distribution. The Chi-squared statistic is defined as:

$$\chi^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i} \quad \text{[Eq.6]}$$

where O_i is the observed frequency for bin *i*, and E_i is the expected frequency bin *i* calculated by:

$$E_i = F(x_2) - F(x_1) \quad \text{[Eq.7]}$$

Here *F* is the CDF of the probability distribution being tested, and x_1, x_2 the limits for the bin *i*.

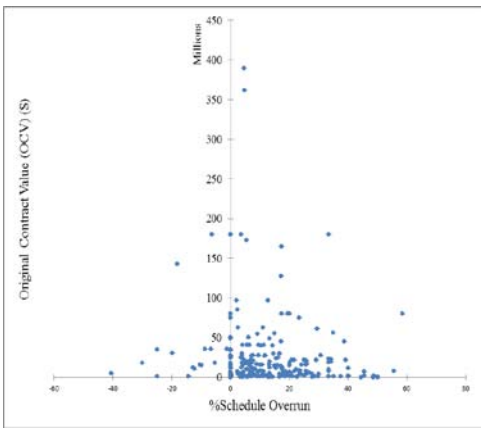
The above 'Goodness of Fit' tests were used to test the null (H_o) and alternative hypotheses (H_1) that the datasets: H_0 - follow the specified distribution; and H_1 - do not follow the specified distribution. The hypothesis regarding the distributional form is rejected at the chosen significance level (α) if the statistic *D*, A^2, χ^2 is greater than the critical value. For the purposes of this research, a 0.05 significance level was used to evaluate the null hypothesis. The *p*-value, in contrast to fixed α values is calculated based on the test statistic and denotes the threshold value of significance level in the

sense that H_o will be accepted for all values of α less than the *p*-value. Once the 'best fit' distribution was identified the probabilities for schedule overruns were calculated using the CDF. Then, to simulate the samples randomness and derive cost overrun probabilities, a *Mersenne Twister*, which is pseudorandom number generating algorithm, was used to generate a sequence of numbers that approximated the sample to 1000 (Matsumoto and Nishimura, 1998).

RESULTS

Data from a total of 276 construction (n=161) and civil engineering (n=115) projects was obtained. In the case of construction projects, these ranged from banks to hospitals and hotels. For the civil engineering sample, these ranged from tunneling to road construction and sewer treatment plants. The summary statistics reveal that the mean original contract value was AU$23,142,486 (SD=A$41,171,772; minimum=AU$132,347; maximum = A$390 million) and the mean actual contract value was AU$25,455,372 (SD= AU$45,090,928; minimum = AU$136,671; maximum = AU$420 million). The actual construction period was an average 4.7 years (SD=3.3 years), ranging from 15 weeks to 3.75 years.

To better understand the sample composition, an examination of respondents' stratification, geographical dispersion, and company turnover was completed for the construction and civil engineering samples. In terms of respondent stratification, 45% were design consultants (architects, quantity surveyors, and structural, mechanical, and electrical engineers), 31% were contractors, and 24% comprised project managers. With regards to geographical dispersion, organizations were situated across states: Victoria (45%), New South Wales (17%), Queensland (27%), South Australia (9%), and WA (2%). The analysis revealed that the average annual turnover of organizations sampled varied: < AU$1m=14%; AU$1 to AU$10m =37%; AU$11 to AU$50m=20%; AU$51 to AU$250m=13%; and > AU$250m=16%. The descriptive statistics for the schedule overruns that were incurred in the sampled projects are presented in Figure 1. The mean overall project schedule overrun for the sample was 11.42% (SD=14.24). Means schedule overruns were also determined for the two groupings of project types: (1) construction 13.07% (SD=16.89%) or 8.88 weeks (SD=24.22 weeks) and (2) civil engineering 11.13% (SD=11.96%) or 4.27weeks (SD=13.76 weeks). The spread of the schedule overruns incurred in each project is plotted against the original contract value (Figure 1).



Range	99
Mean	11.42
Variance	203
Std. Deviation	14.24
Coef. of Variation	1.247
Std.Error	0.857
Skewness	0.389
Excess Kurtosis	1.325

Figure 1. Distribution and descriptive statistics of schedule overruns

An ANOVA test was used to determine whether there were significant differences between the schedule overruns experienced in the construction and engineering projects (p = 0.05). The analysis revealed that there were no significant differences between the schedule overruns experienced between construction and civil engineering projects [F (1, 274) =.413, p = 0.21]..

Probability of Schedule Overruns

The construction and engineering datasets were combined and the 'best fit' probability distribution was examined using the 'Goodness of Fit' tests: *Kolmogorov-Smirnov* and *Anderson-Darling.* The results of the 'Goodness of Fit' tests revealed that Burr *Four Parameter (4P)* distribution provided the best fit for the dataset (Table 3). The Kolmogorov-Smirnov test revealed a *D* statistic of 0.08758 with a *P*-value of 0.2725 and the H_0 was accepted at α = 0.02 and α = 0.01 levels. The Anderson-Darling statistic A^2 was revealed to be 3.0801 and the H_0 was accepted at α = 0.02 and α = 0.01 levels. The Chi-squared (χ^2) statistic was found to be 1.8008 with a *P*-value of 0.0.87596 and the H_1 was accepted.

A Burr distribution is a continuous probability distribution for a non-negative random variable. It has a flexible shape and controllable scale and location and is sometimes considered as an alternative to a Normal distribution when data demonstrate positive skewness. The parameters of the Burr (4P) are all continuous: k is a shape parameter ($k > 0$), α is a shape parameter ($\alpha > 0$), β is scale parameter, and γ location parameter ($\gamma \equiv 0$ yields the 4P Burr distribution). The PDF is expressed as:

$$F(x) = \frac{\alpha k \left(\frac{x-y}{\beta} \right)^{\alpha-1}}{\beta \left(1 + \left(\frac{x-y}{\beta} \right)^{\alpha} \right)^{k+1}} \qquad \text{[Eq.8]}$$

The CDF is expressed as:

$$F(x) = 1 - \left(1 + \left(\frac{x-y}{\beta} \right)^{\alpha} \right)^{-k} \qquad \text{[Eq.9]}$$

The distribution parameters for the sampled construction and engineering projects were found to be: k = 0.19541, α = 2.1247E+8, β = 5.6456E+8, γ = -5.6456E+8. The calculated probabilities of a schedule overrun being experienced are presented in Table 1. The probability of experiencing a schedule overrun of >10% is 45% (P(X > X1), 0.45). Delimiters were also been used to provide probabilities of schedule overruns within ranges. The probability of a project experiencing between a 1% and 10% schedule overrun, for example, is 36%. For a mean schedule overrun of 15.91% the likelihood that a project's duration is extended by this amount is approximately 60% (P (X < X1) = .60)

Table 1. Probability of schedule overruns

Probability of a cost overrun between:	**P(X1 < X < X2)**	**Probability cost overrun**	**P(X < X1)**	**P(X > X1)**
1 and 5%	0.17	5%	0.36	0.64
6 and 10%	0.19	10%	0.55	0.45
11 and 15%	0.14	15%	0.60	0.40
16 and 20%	0.09	20%	0.78	0.22
21 and 25%	0.07	25%	0.85	0.15
26 and 30%	0.05	30%	0.9	0.10

IMPLICATIONS FOR MANAGING SCHEDULE RISK

Determining the likelihood of a project to experience a schedule overrun from contract award is a risk that clients and construction organizations generally fail to consider. Instead, emphasis has generally focused on the potential for cost increases by adding a contingency into the contract value. However, there is a proclivity for schedule contingency to be contained within a project's construction program as 'float' or 'slack'. This is the amount of time that a task in a project network can be delayed without causing a delay to subsequent tasks (free float) and/or its completion date (total float). Tasks are often delayed by rework, which can significantly contribute to schedule overruns being experienced and negatively impact construction-related tasks (e.g., productivity), completion dates, and resourcing (Love, 2002). While 'float' has been conventionally used as a risk management mechanism to accommodate for client initiated change orders, clients and construction organizations have tended to place emphasis on assessing risk they can control by establishing deterministic estimates of duration and cost. This approach invariably anchors project teams to early optimistic estimates. Assumptions, omissions, and qualifications, particularly for the determination of projects schedule duration, are made to establish as basis for the project from a tactical and operational perspective. It is often assumed that risks, particularly with delays and schedule overruns, will reduce with time and progress.

The volatility of strategic risks will invariably vary over time, particularly in the case of design errors, as they enter a period of incubation, and 'when' or 'if' discovered may have disastrous consequences on a project's schedule or a facility's structural integrity. Failure to recognize volatility may result in the uncertainty surrounding schedule risk being understated. For example, tactical risks such as those associated with errors in contract documentation, change orders and the procurement of materials significantly reduce as a project's schedule time reduces. It is frequently assumed by practitioners that any risks not considered in the deterministic estimate and covered by contingency during the design development process will not be taken into consideration at contract award.

CONCLUSION

To manage and control the risk of schedule overruns, its probability of occurrence must be determined. Using data obtained from 276 construction and engineering

projects, the statistical characteristics of schedule overruns were analyzed. Using the contract award as a reference point, schedule overruns from 276 construction and engineering projects were calculated. The mean schedule overrun was revealed to be 11.42% from contract award. No significant differences for schedule overruns were found between procurement method, project type and contract size. The empirical distributions for schedule overruns were found to be non-Gaussian and non-parametric 'Goodness of Fit' tests were used to select the best fit probability distribution. A 3-Parameter Burr probability function was found to provide the best overall distribution fit to calculate the probability of schedule overruns. It is suggested that distribution fitting of empirical distributions is necessary to produce reliable and realistic schedule overrun probabilities and as a result improve decision-making. The research has consequently provided an initial platform to examine the probability of schedule overruns. Determining the best fit distribution is pivotal to calculating realistic schedule overrun probabilities. Further research, however, is required to extend the dataset and test the reliability of probabilities that have been produced.

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COMPARATIVE ANALYSIS OF PERFORMANCE OF LABOUR ONLY AND DIRECT LABOUR CONTRACTS IN SOUTHWESTERN NIGERIA

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ABSTRACT

The construction industry in Nigeria is faced with challenges in the execution of construction projects involving labour -only contract and direct- labour contract. This study therefore compares the performance of labour only and directly employed labour contracts in southwest Nigeria. Qualitative data was obtained from the consultants and key management staff of the companies that are responsible for decision-making via in-depth interview. Quantitative data was obtained through administration of questionnaires using 5-point likert scale to measure the labour productivity and the performance of other project variables. Descriptive and inferential statistical techniques were used for the analysis. The study revealed that the productivity performance is higher in labour- only contract than direct- labour contract executed in the same context and working environment. It then concluded that the use of labour-only contract should be more embraced than the direct labour contract in Nigeria.

Keywords: construction, direct-labour, labour-only, performance, productivity.

INTRODUCTION

The construction industry is recognized as an independent and profitable sector of the national economy of a country in developed parts of the world. It is regarded as a significant source of direct employment and contributes through its wide range of operation and projects to the growth and development of virtually all other economic sectors (Chua, 1996). In developing country like Nigeria due to downward trend in economic situation of the country, the procurement methods prominently used are Labour

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only contracting and Direct Labour (Ogunsanmi and Iyagba, 2003) others include Design and Build, and Traditional Contracting. Moreover, a construction project is a complex process that has defined level of periodic productivity that correlates with the overall goal of the project (Idoro, 2002). It is therefore important to compare the productivity performance of some procurement methods (such as Labour only and Direct labour contracting methods) with each other to determine which is better in meeting the overall goal of the project in terms of cost, quality and time (Loh and Ofori, 2000). The study therefore compared the performance of Labour only and Direct Labour contracts in South western Nigeria to determine whether the performance of Labour Only Contract is higher than Direct Labour Only Contract.

RELATED WORKS

Construction sector is one that values cost, time, and quality performance of any project undertaking in its highly competitive, global and open business environment, by effective utilization of different available resources to achieve maximum output with less input. The combined effect of the efficient and effectiveness of an economy in the utilization of resources leading to tremendous impacts in the form of competiveness employment, income and inflation, profitability, standard of living and balance of payment is productivity Chukumaobi (2002). In construction industry labour productivity is defined as the best way construction workers utilize efficiently and effectively the available resources in most economic manner to achieve a set goals and objectives Fagbenle (2006).

Labour Only and Direct labour Contracting Systems

Ogunde (2011) identified labour only contract as one of the project procurement methods used in the construction industry in Nigeria, which principally involves the client and the contractor. In the labour only contract the client provides all the materials required for the project while the contractor provides the labour force and he is equally paid for the cost of labour including his overhead and profit by the client (Ogunsanmi and Bamisile 1997). However, the client needs to institute some cost montoring controls on the contractor for better management of the project. Surveys of National law and practice on the use of labour only contract reveals that there are two consistent elements which must be present for a work arrangement to be a contract labour situation. Firstly, there should be contractual arrangement under which a worker under takes work for a person or organization other than under a contract of employment. Secondly, there should be some elements of economic or organizational subordination or dependency between the worker and the person for whom the work is performed (Adenuga, 2003).

Fagbenle (2005) refered to direct labour system as an arrangement where a client, organizes the various operations involved in the construction and use both the materials and manpower at his disposal towards the realisation of a successful project. It is also expressed as a system whereby a client uses his/her own in-house resources for the production of the design and the actual construction of a project (Odunlami, 1996). Oyefeko (1988) classified direct labour system into two which are direct labour approach by a client who is an individual; and direct labour approach by a client who is a partnership, corporate body or government. Seeley (1976) gave the merits of direct labour

system as allowing for full control of activities of operatives, thereby permitting reasonable flexibility and direct quality control. It also gives the operatives in-depth knowledge of the building process and becomes familiar with the user`s requirements and any constraints on the execution of the work. Fagbenle, (1999) emphasized that direct labour system however creates unnecessary idle time owing largely to administrative bottlenecks. It does not recognize the use of cost control analysis as fund control measure. Another essential feature of the direct labour system is that the nucleuses of the operatives are employees of the organization that is embarking on direct labour system. Again, the client does everything in direct labour approach whereas in labour-only contracting, construction risks are shared between the owner and the contractor. According to Omolemhamham (1990), equipment – based intensive and community based are some of the characteristics commoners/factors associated with the direct labour method of project execution.

Measurement of Project Performance

Seeley (1996) observed that the traditional project measure of cost, time, and quality are frequently used to measure contractor`s performance by clients. Hatush and Skitmore (1997) grouped the factors affecting the environment of construction projects under cultural, economic, political, social, physical, aesthetics, financial, legal, institutional, and technological and policy. Moreover, the neglect of quality has a detrimental effect upon time and cost performance. Other influencing factors identified include other non-traditional measures such as health, safety, material waste and management expertise (Smallwood, 2000). Maloney (1990) expatiated on the seven dimensions of performance to contractors, such variables as they apply to effectiveness, the degree to which the objective of an oganisation is met, efficiency -the ratio of the resources to be used on a project to the resources actually used. Quality which involves conformity to specification, productivity was defined as the ratio of output to input where output is the physical units of construction achieved and input is the man-hour used to achieve the output. Innovation refers to creativity, discovery of new and better materials and response to change. Lastly, profitability expressed as the ability of the contractor to generate adequate revenues in excess of the cost incurred.

Performance of Labour Only and Direct Labour Contracts

Ogunsanmi (2000) carried out comparative study of the performance of labour-only contracting and direct labour procurement systems in three states of Nigeria and concluded that labour only contracting performed better than the direct labour approach. Adenuga (2003) also investigated the labour only contracts in Nigeria and concluded that the system is becoming an increasing prominent feature of the construction labour market. Dada (2003) made a case study of Lagos state indigenous contractors` performance with contracting measures and concluded that there is no significant difference in the assessment and rating of the identified measures of contractor`s performance.

METHODOLOGY

A total of 100 questionnaires were distributed to selected Consultants, Clients, Contractors, Operatives based in the South Western part of Nigeria that had been

involved in projects with labour only and direct labour contracts across the nation. Twenty five questionnaires were distributed equally to the Consultants, Clients, Contractors and Operatives respectively. Qualitative data was obtained from the Consultants and key management staff of the companies that are responsible for decision-making via in-depth interview. Quantitative data was obtained through administration of questionnaires using 5-point likert scale to measure the labour productivity and the performance of other project variables. Descriptive and inferential statistical techniques were used for the analysis. The data computation was carried out using the Statistical Package for Social Scientists (SPSS) and the following presentation shows the background and characteristics of the respondents.

Out of the hundred (100) questionnaires administered on the respondents, only twenty (20) for the consultants, twenty three (23) for the contractors, fifteen (15) for the clients, and fourteen (14) for the operatives, a total of seventy two (72) completed set of questionnaires could be-retrieved. This represents a total of average of 72% of respondents which is good enough to draw inference on this study (See Table1).

Table1: Respondents` Characteristics

Respondent	Questionnaires served	Questionnaires received	Percentage (%) received
Contractors	25	20	80
Consultants	25	23	92
Clients	25	15	60
Operatives	25	14	56
Total	100	72	72

Table1 shows that 80% of the contractors returned the questionnaires, 92% and 60% responses from the consultants and clients respectively. The average total is 72%. This is a very high response.

Educational Attainment and Years of Experience of the Respondents

The analysis revealed that thirty (41.7%) respondents have at least HND/BSc, twenty two (30.6%) respondents have M.Sc and higher qualifications, thirteen (18%) respondents have NCE/OND while only seven (9.7%) of them possess Technical/WASC. It shows that most of the respondents are highly qualified educationally. Also, Table 2 shows that eighty percent (80%) of the respondents have more than ten years of working experience

Table 2: Years of Experience of the Respondent

Period	Number of Respondents	Percentage (%)
1 – 10 yrs	4	28
11 – 20 yrs	39	52
21 – 40 yrs	27	16
40 yrs and above	2	4
Total	72	100%

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in the construction industry and twenty percent (20%) have more than twenty years of experience. It can therefore be assumed that the respondents have good understanding of construction processes.

Respondents Experience in Labour only and Direct labour Contracts

Tables 3 and 4 show the staff strength of the construction firms investigated and their involvements in labour only and direct labour contracts. Over seventy percent of the respondents have experience in labour only and direct labour contracts.

Table 3: Staff Strength of the Respondents Firms

Employed	Number of Respondents	Percentage (%)
1-50	43	59.7
51 – 100	22	30.6
101-200	4	5.5
>200	3	4.2
Total	72	100%

Table 4: Respondents Experience in Labour Only and Direct Labour Contracts

Labour only Contract	Direct Labour Contract
Yes 60 (83.3%)	Yes 57 (79.2%)
No 12 (16.7%)	No 15 (20.8%)
Total 72 (100%)	Total 72 (100%)

Variables Affecting Performance of Labour Only Contract

The variables affecting the performance of labour only contract were measured and ranked to determine how these variables affect performance in the delivery of labour only contract (See Table5).

Table 5: Variables Affecting Performance of Labour Only Contract

S/N	Variables affecting performance	Response Rate					Mean Score	Rank
		1	2	3	4	5		
1	Availability of Materials	2	6	7	15	42	4.24	1
2	Availability of funds	4	6	6	13	43	4.18	2
3	Availability of tools and equipment	3	6	7	32	24	3.94	3
4	Poor supervision	3	5	8	36	20	3.90	4
5	Poor communication	4	6	13	34	15	3.69	5
6	Skill of Workforce	1	6	34	23	8	3.43	6
7	Lack of information	4	10	41	12	5	3.06	7
8	Mode of Employment	8	43	10	5	6	2.42	8
9	Distrupted days	35	14	13	7	3	2.01	9
10	Construction method	41	15	8	5	3	1.81	10

11	Availability of labour	39	18	9	4	2	1.78	11

(The aggregate mean of the factors affecting performance of labour only contract is 3.17)

Table 5 shows that labour only contract is mostly affected by lack or in-availability of materials (4.24) at the required time, quality and quantity. The supply of materials is usually done by the client and any delay by the client in supplying the materials most often affects the performance of the contractors' involved in labour only contracts. Availability of labour (1.78) is the least factor affecting the performance of labour only contract because the supply of labour is the sole responsibility of the contractor and forms the basis of labour only contract. The Availability of funds (4.18), Tools and Equipment (3.94), Poor supervision (3.90) and the Skill of the workforce (3.43) are important variables that determine performance of labour only executed projects.

Variables Affecting Performance of Direct Labour Contract

The variables affecting the performance of labour only contract were measured and ranked to determine how these variables affect performance in the delivery of direct labour contract (See Table 6).

Table 6: Variables Affecting Performance of Direct Labour Contract

S/N	Variables affecting performance	Response Rate					Mean Score	Rank
		1	2	3	4	5		
1	Disrupted days	1	3	9	14	45	4.38	1
2	Poor communication	3	2	5	17	45	4.38	2
3	Availability of funds	1	3	6	21	41	4.36	3
4	Mode of Employment	2	4	8	20	38	4.33	4
5	Lack of information	3	3	6	15	45	4.33	5
6	Availability of labour	2	4	9	18	39	4.22	6
7	Availability of Materials	2	4	7	27	32	4.15	7
8	Availability of tools and Equipment	5	5	7	23	32	4.00	8
9	Skill of Workforce	8	23	34	6	1	2.57	9
10	Poor supervision	20	36	8	5	3	2.10	10
11	Construction method	34	24	8	4	2	1.83	11

(The aggregate mean of the factors affecting performance of direct labour contract is 3.70)

The result of the findings shown in Table 6 reveals that direct labour contract is mostly affected by disrupted days due to bureaucracy (4.38), poor communication among parties involved in the contract (4.38), lack of funds (4.36) and the mode of employment (4.33) which makes the employees to be paid salaries or wages at specific days whether or not the work has been done or not. Other equally important factors are Lack of availability of labour, materials tools and equipment. Construction method (1.83) is the least factor that affects performance in direct labour contract. It can thus be inferred from Tables 6 and 7 that labour only has more resistant (3.17 Aggregate mean) to the factors affecting

performance than direct labour (3.7 Aggregate mean) because of extra commitments on the part of the contractor.

Parameters for Measuring Performance in Labour Only Contract

The basic determinants for measuring the performance of delivery of projects in terms of time, cost, quality, health and safety and Overall performance of labour only contracts were analysed and ranked in Table7.

Table 7: Labour Only Contract Performance Measures

S/N	Performance Determinants/Parameters	Response Rate					Mean Score	Rank
		1	2	3	4	5		
1	Time	1	3	9	11	48	4.42	1
2	Cost	3	2	5	17	45	4.38	2
3	Overall performance	3	3	6	15	45	4.33	3
4	Quality	10	21	6	19	16	3.14	4
5	Health and Safety	38	26	12	4	2	2.49	5

(The aggregate mean of performance determinants of Labour only contract is 3.75)

The result shown in Table7 revealed that labour only contracts performed best in Time delivery (4.42) of projects and least in Health and Safety (2.49). Cost was ranked next by the respondents and closely followed by overall performance. The result is in agreement with the findings of Fagbenle (2006, Ogunsanmi and Iyagba, Ogunsanmi (2000), Loh and Ofori (2000), Wong (1990) and Choo (1986)

3.6 Parameters for Measuring Performance in Direct Labour Contract

The basic determinants for measuring the performance of delivery of projects in terms of time, cost, quality, health and safety and overall performance of labour only contracts were analysed and ranked in Table 8.

Table 8: Direct Labour Contract Performance Measures

S/N	Variables affecting performance	Response Rate					Mean Score	Rank
		1	2	3	4	5		
1	Health and Safety	2	4	6	22	44	4.41	1
2	Quality	15	21	6	19	49	3.6	2
3	Overall performance	5	25	16	13	15	3.11	3
4	Cost	47	12	4	4	2	1.58	4
5	Time	44	23	3	2	1	1.53	5

(The aggregate mean of performance determinants of Labour only contract is 2.85)

The result shown in Table 8 revealed that that direct labour contracts performed best in Health and Safety (4.41) of personnel involved in execution of the project and least in

Time delivery of the project (1.53), which often leads to cost overrun. Quality was ranked next by the respondents and closely followed by overall performance. The implications of this findings is that direct labour contract (2.85) is not as effective and efficient in time and cost delivery of projects which are paramount indicators of performance as labour only contract (3.75).

CONCLUSION

The study shows that the project variables that affect project performance are mode of employment, availability of materials, availability of labour, availability of tools and equipment, poor supervision, poor communication, disrupted days and skill of workforce. These variables affect labour only contract and direct labour contracts in varying degrees thereby leading to cost overrun, time overrun, poor quality and health and safety challenges.

However, when the study compared the performance of labour only and direct labour contracts in SouthWestern Nigeria to determine whether the performance of labour only contract is higher than directly employed contract, it revealed that the productivity performance is higher in labour- only contract than direct- labour contract executed in the same context and working environment. Also, direct labour contract is not as effective and efficient in time and cost delivery of projects as labour only contract which are paramount indicators of performance. Direct labour system however creates unnecessary idle time owing largely to administrative bottlenecks. It does not recognize the use of cost control analysis as fund control measure This is in agreement with the findings of Fagbenle (2006), Ogunsanmi and Iyagba, Ogunsanmi (2000), Loh and Ofori (2000), Wong (1990) and Choo (1986). It is therefore concluded that the use of labour-only contract should be more embraced than the direct labour contract for construction projects in Nigeria and also recommended that all efforts should be geared towards improving cost and quality performance of labour only contracts.

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THE SOFT SYSTEMS APPROACH TO UNDERSTANDING TRUST IN ALLIANCES IN AUSTRALIA

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ABSTRACT

Alliances are complex projects with high levels of risk and uncertainty. Despite the pain share and gain share commercial arrangement in alliances, Trust is still an issue between the Alliancing Leadership Team (ALT) and Alliancing Management Team relationship (AMT). Although the concept and components of trust have been discussed by various researchers, the characteristic of trust under different situations has not been tested within the procurement research domain. Based on semi-structured interviews with the members of the ALT and AMT of an alliance project in Australia the underlying trust based relationships between the AMT and ALT were investigated using the Soft Systems Methodology (SSM). Results demonstrate that cognitive, affect, system and cognitive-affect based trust are mediated by common good, needs, sharing, breach temptation and mishap situations. This research demonstrates that the adversarial culture of the Australian construction industry cannot be changed by the implementation of trust principles alone. The culture of suspicion dominating the ideological view of the construction industry requires organizational learning between alliance parties to execute appropriate behaviours, aligned with the alliancing philosophy, to effectively achieve ideal collaboration.

Keywords**:** Alliances, adversarial culture, soft systems, trust

INTRODUCTION

Research on project alliancing in Australia has revealed that communication and trust between the Alliance Leadership Team (ALT) and Alliance Management Team (AMT) was a major issue that impacted on the effectiveness of the alliance (Mills and Harley 2010). The precondition for project alliancing to be successful is to develop a trust framework that allows the ALT and AMT to deliver superior project management coordination. The principle objective of Alliances is to align team

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member expectations so that they work together for the benefit of the project (Mills et al. 2012).

The Construction Industry Institute Australia (CIIA 1996) and Larson and Drexler (1997) suggested that developing trust was pivotal to the success of partnering projects. Project alliancing in relational contracting is similar to partnering for the purpose of achieving mutual goals in the delivery of the project but this method is mainly used for infrastructure and large projects where there is high level of complexity as well as opportunity for innovation. More research is needed to explore how trust affects the AMT and ALT which are formed specifically for the purpose of project alliancing.

Project alliancing can be defined as a project delivery form in which "the owner collaborates with one or more service providers to share the risks and responsibilities in delivering the capital phase of a project (DTF Victoria 2006). In alliancing each alliance member places their profit margin and reward structure "at risk" so the entire alliance entity either benefits together or lose all (Walker et al. 2002). This then creates a motivation to collaborate and cooperate within the alliance relationship. Alliances operate on the principles of mutual trust, commitment and communication to reduce conflict and enhance productivity as well as overall performance (Lee and Cavusgil, 2006).

According to Mills et al (2012) an alliance is formed by the ALT and AMT. The ALT is in charge of the strategic decision making of the project as well as supporting the AMT team whilst the AMT is in charged with the operation of the project. The ALT team includes the client and determines the Target Turnout Cost (TOC), which is the agreed amount the building would cost to deliver (Walker et al. 2002). The AMT would include personnel from the contractor's side. Both AMT and ALT would have representatives from both the client and contactors' side to facilitate equity, knowledge as well as collaborative spirit in decision-making.

A normative frame is important for trust in a business relationship. It largely suspends opportunistic behaviour when interests are aligned. Legitimate mistrust is the perceived likelihood that a potential or actual transaction partner's interests are not aligned with one's own interests and that the partner's actions are driven by a salient gain frame such that relational and normative considerations are pushed into the background (Lindenberg 2000). Trust has been defined by different scholars over the years as predictability on human behavior (Cheung et al. 2003). For the nature of the construction industry,Robinson's (1996) definition of trust that "[it] is "one's *expectations, assumptions*, or *beliefs* about the *likelihood* that another's future actions will be beneficial, favorable, or at least *not detrimental to one's interest*" is most applicable to this research which is investigating the stability of trust between the ALT and AMT relationship within alliancing projects.

This definition of trust isn't the most optimistic in outlook but it implies that even if the parties are not absolutely considerate of each other's interests at least their actions will not be detrimental to the extent that it would break the partnership of shared

goals. This allows legitimate inherent mistrust to co-exist with trust and so it is the certainty of trust at any given point of time or situation that can be predicted to determine the intention of future behavior.

Distrust however is understood to be the "expecation that others will not act in one's best interests, even engaging in potentially injurious behaviour" (Govier 1994, Lewicki et al. 1998) and the "expectation that capable and responsible behaviour from specific individuals will not be forth coming" (Barber 1983; Lewicki et al. 1998). Mistrust is when there is lack of confidence or doubt as there may be a hidden agenda but not necessarily imply that there is serious malicious suspicion. Mistrust can occur in a positive state of a relationship and may even assist in the building of trust as parties communicate more openly regarding potential issues before the commencement of the partnership. Distrust is a negative attitude and signifies that there is an issue or conflict that needs to be resolved in a trustworthy manner or else all endeavors to build trust within a relationship would be rendered ineffective.

Mistrust can transform into distrust through miscommunication, misunderstandings and untimely resolution of issues both explicitly and implicitly known to one or both parties. In a highly adversarial construction industry, there are currently high levels of distrust beyond legitimate inherent mistrust. It is distrust which is hindering trust. Based on Lindenberg (2000) there are five situations affecting the conditions of trust in collaborative relationships. The five situations are namely *common situation*, *sharing situation, need situation, breach temptation and mishap situations.*

Trust has been identified as a driver of alliancing projects however it has also been identified as an issue between the ALT and AMT relationship. Although the concept and dynamics of trust has been defined and discussed by various researchers (Wong et al. 2008; Mayer et al. 1995; Rousseau et al. 1998) the situational impact of trust on the behavior of individuals between the ALT and AMT within alliancing projects has not been tested and is clearly a gap within the construction research domain. It can be hypothesized that in the culture of suspicion within the contemporary society, the adversarial attitude between construction professionals becomes entwined among individuals' past experiences, contractual obligations and confusion in the behavior expected within different procurement systems. It is important to understand trust from the perspective of its volatile nature in order to predict the likelihood of an individual's actions of either fostering trust or deviating towards distrust.

This research aims to capture the trust conditions affecting the AMT and ALT in the context of the Lindenberg's five situations as mentioned above. The objective of this research is to investigate under what conditions trust is facilitated and tarnished between the ALT and AMT relationship within alliancing projects.

METHODOLOGY

Soft Systems Methodology (SSM) is a powerful methodology for inquiring into complex situations (Checkland, 1981). It is a dynamic method that offers a people centred way to examine the problem areas and focuses to intervene in a messy situation in order to improve it in a structured way. SSM methodology comprises two

key steps in conceptualizing the real world picture into a structured outcome. Firstly, a rich picture is developed for careful assessment of the real world issues based on participants' responses. Secondly, a CATWOE (Customers, Actors, Transformation, Weltanschauung, Owners, Environmental Constraints) analysis is performed to demonstrate the various underlying elements affecting the measured phenomena. Finally a conceptual model is derived.

In this research, a total of nine participants selected from the Alliancing Association of Australia working in the ALT and AMT from a building alliance were interviewed. The building alliance was a refurbishment of an arts centre in Victoria. The risk and reward allocation was heavily placed on the non-owner participants in the event of a cost overrun or under run in the final TOC performance. From the ALT, there was a design representative, a construction representative and three client representatives. From the AMT, there was a design representative, a construction representative, and a client representative as well as an Alliance General Manager which chaired the AMT. Every respondent had more than 16 years of experience within the construction industry although only one of the participants had worked on more than one alliancing project in during their entire career within the construction industry. This demonstrates that alliancing contracting is not used as nearly as much compared to the Design and Construction procurement method for complex projects.

A university ethics clearance was obtained articulating the process of the interview. For the purpose of protecting their identity in the interviews, an agreement was signed between each participant and the researcher that the name of the alliance would be kept anonymous due to the commercial sensitivity of some of the information that was been given for this research. The participants were asked a set of questions on the conditions of trust between the ALT and AMT relationship within the alliancing projects that they had worked on. A set of questions were also asked to cross examine and confirm their position on their perception of their view points. The questions were semi-structured for the development of the rich picture to find out what the 'wicked' problems were from each participant's perception of the complicated trust issues that occurred within the alliance.

DATA ANALYSIS

Figure 1 depicts the rich pitcure of an effect of cost over runs on the trust conditions under different situations between alliance parties via the ALT and AMT in pain sharing mode. The black arrows represent the direction of the trust attitude between parties under a particular situation. The dotted lines show the functional links between the parties. As seen in both cost overrun and under run scenarios, clients, sponsors, non-owner participants (NoP; designers and contractors) and end-users are the key customers with the highest stake on the project decisions. The actors include Alliance General Managers, ALT and AMT members, consultants and wider project group who are perceived to have the critical roles in terms of achieving "Best for Project" outcomes.

The transformation is governed by the relevant knowledge, processes and technologies that allow the identification of the underlying causes of trust mistrust and distrust conditions associated with different situations between parties under cost overruns and under runs modes. Weltanschauung refers to the phrase "why brother"

and the root cause being bothered is the adversarial attitude between alliance parties which affects the trust between the ALT and AMT in achieving ”Best for Project” outcomes. The environmental constraints are the competition, legislative regulations, environmental sustainability, community perceptions and corporate objectives.

The rich picture demonstrates that under the pain share mode in the common good situations, cognitive-affect (communication related) and system based trust (contract related) are being affected. The reason is that in a pain share mode, the performance of one or more alliance parties has already created a conflict and therefore, the communication between the parties involved become a critical point to determine how the conflict is resolved. Figure 1 depicts a rich picture of the interviews with the ALT and AMT participants.

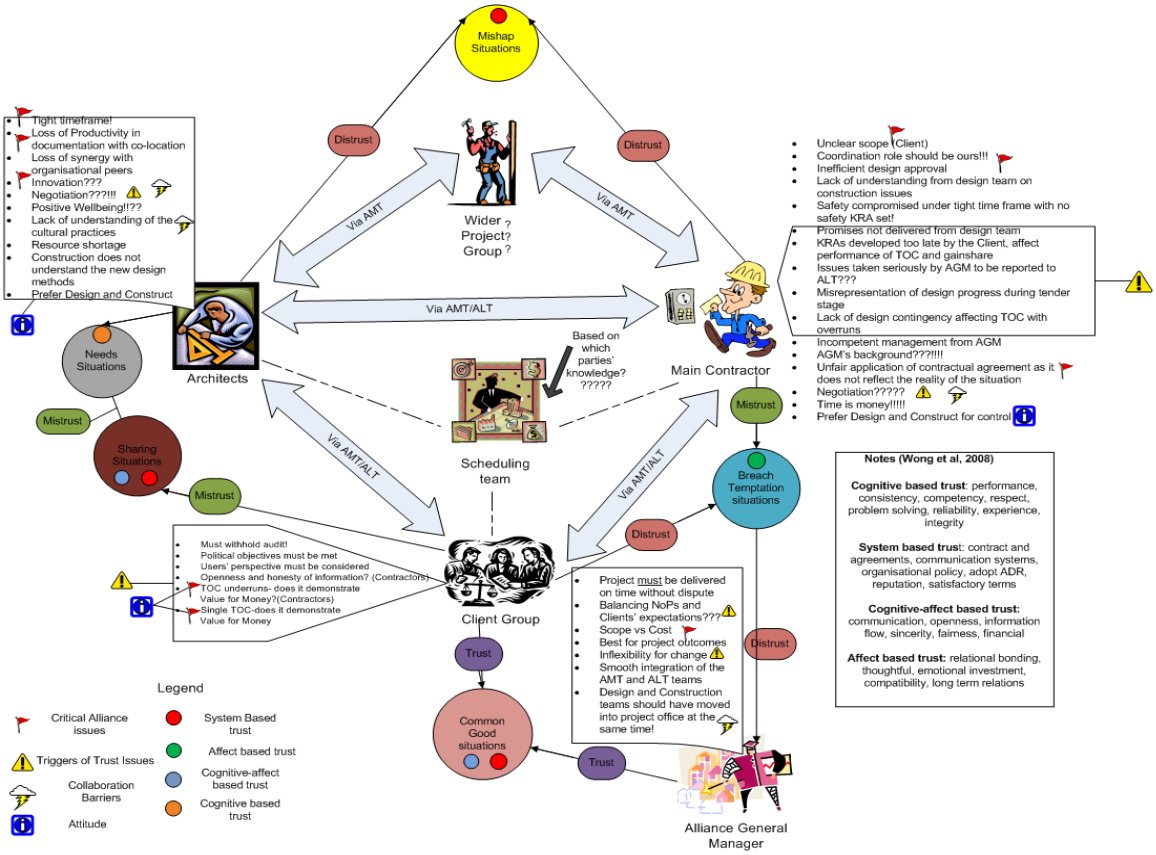

Figure 1. Trust conditions under pain share mode

In breach temptation situations, affect based trust (long term relations) is being affected under a pain sharing mode This is due to a ‘no sue’ clause within the Project Alliance Agreement. Under a pain sharing mode, system based trust determines the extent of distrust versus trust under mishap situations. In sharing situations cognitive-effect and system based trust are being affected under a pain sharing mode. In needs situation cognitive-affect based trust is being affected under a pain sharing mode, demonstrating that alliances are business relationships based on performance and common goals. This demonstrates that the contractual terms (i.e. KRAs, TOCs etc)

need to be proven by the performance of the project underpinned by strong communication between parties. Table 2 depicts root definition of rich picture in terms of the CATWOE analysis.

Table 2: Root definition under a pain sharing modes

Elements of CATWOE	**Description**	**Outcome**
Customers	Project management agency, sponsors, end users Non owner Participants (NoP), end users	The customers' expectations and how the expectations are understood and communicated are critical to building the trust foundations from the pretender to implementation and handover stages. If the expectations are not understood perfectly then it is the foundation for distrust to arise when conflicts occur.
Actors	Project owner, existing user, Project Management agency , ALT, AMT, wider project team (subcontractors), consultants, financiers,	The interaction and trust between the ALT and AMT is largely controlled and influenced by the leadership of the Alliance General Manager (AGM) who chairs the AMT and reports to the ALT any unresolved issues by the AMT. The perception of trust between the ALT and AMT is therefore highly influenced by the managerial capabilities of the AGM.
Transformation	Understanding the conditions of trust between the ALT and AMT within alliancing projects	There are two trust phenomenon in relation to the performance of TOC: When TOC is above and beyond 5% contingency, trust affects the relationship *among* alliance parties; owners and non-owner participants. The condition of trust *between* the ALT and AMT becomes a reflection of the trust among the alliance parties.
Weltanschauung	To improve the adversarial attitude between project participants so that a best for project outcome and value for money can be achieved	Under the pain sharing mode, the adversarial attitude has not changed although certain adversarial outcomes have been mitigated under the 'no sue' clause of the Project Alliance Agreement (PAA). Mishap situation has an impact on the system based trust under a pain sharing mode especially when there is distrust between the alliance members. Breach temptation has an impact on the affect based trust and is the initial intention of the alliance. Even in a pain sharing mode where there is distrust, there is no intention of breaching the contract.
Owners	Project owner	Perception of the existence and ability to negotiate must be maintained by the owners to foster trust with the non-owner participants. Negotiation is the most preferred method of conflict resolution in Australia within the construction industry. Although alliancing contracting restricts the ability to change the TOC once the PAA has been signed, significant miscalculations of latent conditions must not be ignored. Strict adherence to the PAA without fair consideration of the implication to the non-owner participants' profit margin and gain sharing outcome creates adversarial attitude between the relationships.
Environmental constraints	Political influences, TOC, alliancing best for project practices, culture, identity of individuals within the alliance in respect to their identity in their parent organisation, heritage issues, sustainability,	Under a tight scheduling timeframe, innovation requires the integration of team collaboration between the members of the AMT with the support of the ALT. when the scope of works is unclear problem solving requires cognitive-affect based trust. Unclear establishment of the KRAs have an impact on the cognitive-affect based trust as the KRAs affect the gain share aspect of the profit margin. Ambiguity

	Key Results Areas (KRA), KPI, safety requirements, quality, schedule, community, weather, approvals, unclear scope, emergence	creates ideas for innovation however it is also a catalyst for the perception of uncertainty and risk transfer which the behaviour required for risk sharing.

In the context of alliancing contracting, the 'Adversarial' Trust framework in Figure 2 takes a view that mistrust is an inevitable element of trust even in a "fair" gain share and pain share commercial arrangement within the PAA. Mistrust can develop into distrust in a mishap situation under a pain sharing mode. Mistrust can also facilitate cognitive-affect and system based trust through the understanding of the concerns of the alliance parties under breach temptation situations as the there is a 'no sue' and no blame culture written in the PAA. The contribution of this research demonstrates that the trust between the ALT and AMT is a reflection of inter-organizational trust among the alliance parties. Organizational learning is needed among all alliance parties before any effective trust strategies can be implemented to potentially reduce the culture of suspicion, currently dominating the ideological view of the construction industry.

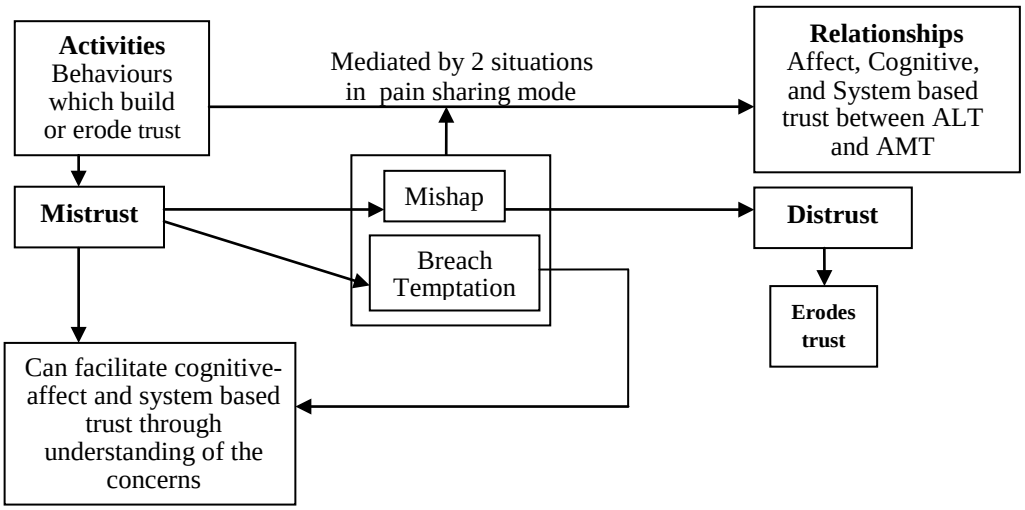

Figure 2: Adversarial' Trust framework developed from SSM

CONCLUSION

Trust conditions between ALT and AMT are volatile especially under a pain sharing mode with mishap and breach temptation situations. Cognitive, affect, system and cognitive-affect based trust are mediated by common good, needs, sharing, breach temptation and mishap situations. The distinction between mistrust and distrust also demonstrates that mistrust can co-exist with trust without detrimental effects on cooperation through the facilitation of cognitive-affect based trust. This is determined by the perception of risk sharing across the project life cycle depending on whether the TOC is in a gain share or pain share mode. Trust can only be facilitated in an alliance when Target Output Cost (TOC) has reached its gain share expectations In a pain share mode, distrust is the dominant attitude between all alliance members.

Mistrust can also develop into distrust if a mishap situation is not well handled in the process of negotiation and problem solving. The adversarial attitude between alliance participants under pain sharing mode demonstrates the influences of culture on the effectiveness of collaboration overriding contractual commercial alignment. More research is need in the integrated area of organizational learning and cultural practices to further understand the reality of trust in relational contracting rather than the representation of reality.

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TOWARDS EARLY CONTRACTOR INVOLVEMENT FOR INFRASTRUCTURE PROJECTS IN GERMANY

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ABSTRACT

The management of large and complex civil infrastructure projects is often a challenge for the relationship between client and contractor. Many projects often end up in dissatisfaction or even in litigations for both parties. To change this situation, different partnering models and guidelines were established all over the world in the past years. One part of these models, or even a model on its own, is the Early Contractor Involvement. It is used in many countries around the world and comes up with several advantages in improving not only the whole planning, but also the actual situation between client and contractor. Nevertheless, this model is not applicable for public financed civil infrastructure projects in Germany. Until now, the strong regulations for public financed projects and public tendering hinder an adoption of the models from other countries. Hence, the knowledge of the contractors has to be used in other forms in the very end of the planning process or even during the construction phase.

Keywords: cooperative contracting, Early Contractor Involvement, Germany, infrastructure projects, partnering.

INTRODUCTION

The situation in large construction projects all over the world seems to be very similar. Many projects end up in a cost and time overflow whereby the relationship between client and contractor is not very cooperative (Black et al., 2000). Moreover, project participants often complain about too many disputes and litigations. Girmscheid (2005), Ingram and Bennet (1997) and Spang (2009) characterized the typical situation in the German and international construction and plant market by the following facts:

- Dissatisfied clients and distrust between client and contractor/s
- Decrease of Know-how due to “lowest price-principle”
- Increasing expenses for claim and anti claim management
- Growing number of disputes and litigations between clients and their contractors
- Low rate of return and high risk of business failure for contractors.

This situation is not satisfying for either clients or for contractors. Hence, both parties consent that new models for project delivery had to be found.

In the beginning of the nineties, Latham (1994) analyzed the reasons for the dissatisfying situation. He demands, inter alia, for a rethinking of the tendering system and to evaluate the contractor, not only by price criteria but also by quality criteria. Beyond this, he demands to establish preconditions to achieve a win-win situation between client and contractor, to be managed through a partnering approach. Some years later, Egan (1998) recommended that the construction industry should take a look at other industries and use their best practices by implementing them in their processes. Furthermore, clients and contractors should work together to achieve a common goal. To reach these goals, he also demanded for partnership between clients and contractors. Especially in complex projects, like for example big infrastructure projects with limited budget, the traditional way of project handling seems to be insufficient (Sakal, 2005).

During this time, a new concept was established with the Andrew Project of the Oil and Gas Company BP. The project had so many uncertainties that the project success was not certain. That led both parties, but especially the client, to look for a new way of contracting. In this project, contractors are chosen not only by price but also by quality criteria. This was necessary, because the contractors got involved earlier in the project to improve it by bringing in their knowledge. For this, the client needed strong and experienced contractors. The goals of the further project handling were fixed with a fair risk sharing between all parties, better and faster solution of conflicts without court processes and a pain and gain regulation for exceeding respectively failing the jointly fixed project targets. The result of this development was the first form of an alliance contract including an early involvement of the contractors, which leads to a satisfactory project for the client with savings of more than 20 % (Rooney, 2006).

This was the impulse for the Australian construction market to adopt and to develop this way of contracting. In the meantime, until today, alliance contracts including the early involvement of the contractors are used in Australia in the private and public sector more than anywhere else in the world (Ross, 2009).

Worldwide, especially in the private sector, fast changes towards more partnerships are applicable. In contrast, changes in the public sector are relatively slow, because of stricter regulations. However, international construction markets are rather different in matters of market conditions, legal situations and public authorizations.

EARLY CONTRACTOR INVOLVEMENT

Reasons for Early Contractor Involvement

Worldwide there are many forms of Early Contractor Involvement (ECI) in the construction industry. Originally ECI was established in the UK during the 1990s and has been introduced in Australia since 2005 (Swainston, 2006). Here it is not only used in the Alliance Contracting, a special form of contract for construction works, but also in the pure form of just involving the contractor earlier in the project. The big advantage of the early participation of the contractor during the design phase is the possibility to use his knowledge for improvements of the planning. In traditional contracts the client hires an architect or engineer for the design. During this period the architect/engineer and the client work together until the design is finished. One advantage of this execution model is that the designer is an independent person and just focuses on the demands of the client and not on the targets of a contractor’s company. On the other

hand the big disadvantage is that designers sometimes have just limited knowledge of the execution of the construction works because they are often not involved in the execution phase of the planned project. Thus he often gets no feedback for his design work and cannot improve it for example by "Lessons Learned". In contrast, the contractor has exactly this missing knowledge. If he can be involved in the planning phase, his Know-how can be used to improve the project (Gil et al., 2000).

Assaf & Al-Hejji (2006) proved the importance of good planning by a survey on time performance on projects in Saudi Arabia. In this survey 23 contractors, 19 consultants and 15 clients took part. Inter alia, Assaf and AL-Hejji found the following influencing factors on project duration which can be allocated to the planning phase:

- Mistakes and gaps in design documents
- Delays in producing design documents
- Unclear or inadequate drawings
- Complexity of project design
- Misunderstanding of owner's requirements by the design engineer
- Inadequate design-team experience.

Furthermore they state that by involving the contractor earlier in the project the impacts of these factors can be reduced or completely prevented. Moreover, through this early involvement the constructability can be enhanced (Proverbs and Holt, 2000), which may also lead, in most cases, to positive effects on time and cost performance.

In particular, changes in the scope of the project are much easier and cheaper during the design phase than during the execution phase. In Figure 1 the influence on project costs in the different stages during a construction project is shown. While in the conceptual design about 80 % of the costs can be influenced in the construction phase the amount decreases to c. 10 %. In contrast the costs of a change in the scope rise during the project duration. Even some changes will not be possible in the late project stages.

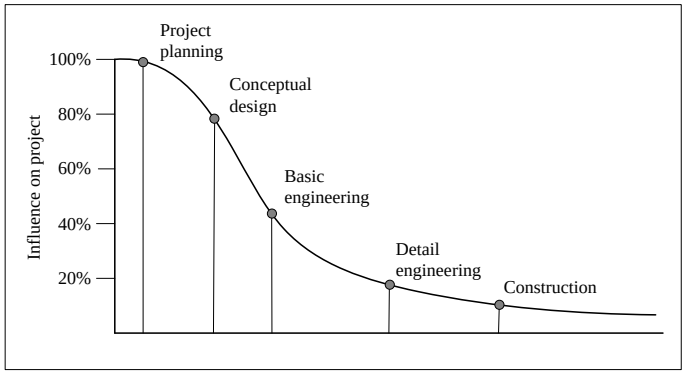

Figure 1 Influence on project costs (Scott, 2001)

Benefits also arise for the contractor by getting involved earlier in a project. In the traditional model, contractors get a comparatively short period of time to check and understand all documents and plans. On this basis they have to make an offer to the client. Until this point they have to understand the design work, have to think about how to build it and have to check if there are any (hidden) risks in the documents. By getting involved earlier, they have a longer time for the process and have more security that they did not miss something important. In a field study, conducted by the Chair of Project Management in 2006, 126 practitioners (57 clients, 54 contractors and 15 third parties involved) were asked about the applicability of risks in the tender documents (Figure 2).

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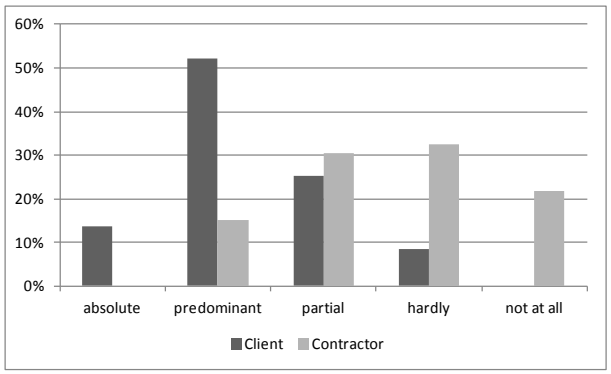

Figure 2 Risks are recognizable in the tendering documents (Spang et al., 2009)

More than 60 % of the clients stated that they are absolutely or predominantly applicable, while just 15 % of the contractors had the same opinion. The majority of the contractors, about 55 %, answered that the risks are hardly evident or even not applicable in the tender documents. In this point just 8 % of the clients agree with them. This different point of view on risks in tendering documents could be fixed by an earlier involvement of the contractors in the planning process. Hereby contractors get in touch with the project and thereby also with the risks, before they make an offer, which allows them to offer a risk adjusted price.

Another reason for an earlier involvement of the contractors could be found in the answers the practitioners gave on the question if the contractually agreed scope is clearly described in the tender documents (Figure 3).

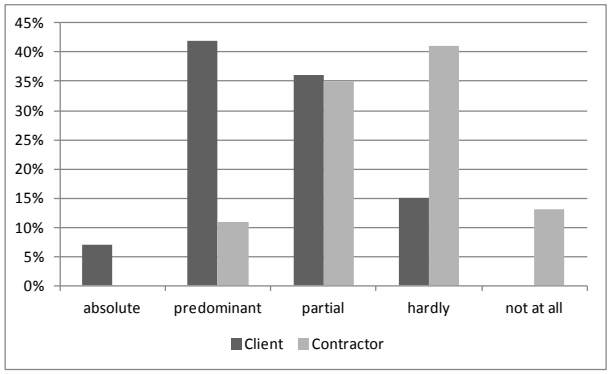

Figure 3 Clearness of the contractually agreed scope (Spang et al., 2009)

Nearly half of all participating clients (49 %) state that the contractually agreed scope is absolute or at least predominantly clearly described, while the majority of the contractors (54 %) stated the opposite. Clients are convinced to have described the scope perfectly based on a high design quality but contractors find shortcomings and space for interpretations. This is a possible reason for many disputes between client and contractor later during the construction phase. An earlier involvement of the contractors, using their knowledge, and the development of the plans together, could also help to solve this problem.

In short, the main benefits of ECI can be summarized as follows:

- Use of contractor's Know-how to improve the project
- Reduction of mistakes in design documents
- Better risk-understanding
- Enhanced constructability

- Better overall project performance (cost, time, quality, satisfaction)

Process of Early Contractor Involvement
In this chapter, the ECI-procedure will be described in a 'pure' ECI Model from Australia and the 'Bouwteam'-Model from the Netherlands.

Swainston (2006) describes the Australian ECI model as follows: In an ECI project the contractor will be involved right after the business case is finished. He will be chosen through non-price criteria. For this, interviews with the later onsite staff, the managers and the designers are conducted. When the right people, best for the job are found, a two stage process begins. But although it is divided into two parts, the contractor gets just one contract for the design and the execution phase. In the first stage, the contractor in collaboration with his designers and the client designs the project to a stage, that it can be priced exactly. Client, contractor and the contractor's designers work together in an alliance-style relationship with an open-book philosophy. This is necessary to prove that the public funds are spent efficiently and the price for the construction works is not too high.

On the basis of this design stadium, the contractor presents the client a risk-adjusted offer for the works. That means that the contractor includes a special 'risk-budget' for the risks found out during the design phase, which are allocated under his responsibility. If the client does not accept the offer, the contractor will be paid on a time basis for his design work and the project will be tendered like a traditional construction project. This is possible, because the contract includes this 'exit-point' for the client. In the event that the client accepts the offer, the contractor continues his work and the contract will be adjusted. The basis can be, for example, a lump sum contract for the final design, the execution and for the documentation. In this stage, client and contractor work together like in a D&C contract. The contractor finishes the design and builds the planned work. Benefits of this model found in Australia are: shorter time of delivery, lower tender costs, fewer changes during the construction period, better understanding of the project on both sides, higher flexibility and more innovation (Swainston, 2006).

Similar models exist in many other countries of the world, like for example in the Netherlands. The 'Bouwteam'-Model has very similar intentions like the ECI in Australia, although the process is not 100 % exactly the same. In some projects savings of about 20 % could be achieved by using this model (Weber et al., 2002).

Early Contractor Involvement in Infrastructure Projects in Germany
In Germany there exists actually no ECI in civil infrastructure projects like shown above. Till now, the strong public regulations hinder the adoption of these models for the use in Germany. These boundaries result from:

1. The plan approval process
2. The principle of open competition
3. The requirement of transparency
4. The principle of equal treatment

For civil infrastructure projects, the usual planning process is structured in five steps, the basic evaluation, the preplanning (including the route determination), the conceptual design, the plan approval and the execution planning. So, clients get the final approval very late in the planning process, which means a high uncertainty in the stages before. But as shown above, the influences on project costs are higher in the early stages, especially during the route determination. That's why contractors should be

integrated as early as possible – although there remains still a risk for both parties, namely the result of the plan approval which can lead to major changes.

Another obstacle is the principle of open competition in relation to the requirements of transparency and the equal treatment. Either clients have to choose a contractor very early and stay together till the construction is built, but then a price-competition is not possible, or, if they do the planning with one of the contractors and tender the construction works traditionally, they have to ensure an equal treatment of all of them. This means the clients have to make sure, that all of the potential bidders have the same, identical information, which will be hard to achieve. If the client makes a mistake and not all bidders have the same, identical information, any of the disadvantaged bidders could go to court and could make a new tendering of the project necessary.

One slight approach in Germany to use the contractor's knowledge in the very end of the planning phase of public financed infrastructure projects in Germany is the so called 'Funktionsbauvertrag' (Functional construction and maintenance contract). It allows the contractor to improve the design at limited points after the actual design phase is finished. It was developed in the 1990s and can be assigned to the Public Private Partnerships (PPP), because it has very similar regulations (Knoll et al., 1999). Most parts of the contract are tendered on the basis of a unit price without any use of the knowledge of the contractor (Racky & Altmueller, 2010). But some parts of the contract which contain the omitted construction works of the bound superstructure are tendered in a reference construction style. Here, the contractor has the chance to, perhaps, improve the design. This is the only point, where the contractor has very limited, involvement in contrast to the traditional design-bid-built method. After the construction works are finished, the contractor has to maintain the construction for a period of approximately 30 years like in 'normal' PPP-projects. Until today there is just a handful of projects contracted this way and there is no project where the time of maintenance is over. Because of this there are no wide and reliable experiences to evaluate this model. But the first findings are (Pauli, 2006):

- Quality incentives through life-cycle considerations of the contractor
- More innovation through functional description
- Less effort for the client for maintenance
- Better planning of financial resources for the public authorities.

The 'Funktionsbauvertrag' is, as mentioned above, the only way to use the knowledge of the contractor in the planning phase of public financed infrastructure projects.

However, not to leave the contractor's knowledge unused, at the Chair of Project Management of the University of Kassel, a guideline for partnership between client and contractor in public financed infrastructure projects (PPA-Model) was developed by researchers and practitioners from the client's and contractor's side. Moreover, lawyers also accompanied the development. Since 2009 this guideline is tested in Pilot-Projects. It consists of seven elements which aim for partnership between both parties. For the use of the contractor's knowledge especially the last element of the guideline is interesting. There are three cases for optimization in the construction phase given, while the process is always the same. The contractor makes a suggestion for an optimization to the client. If he accepts this, the contractor develops it and makes an offer to the client including all effects (e.g. on time, cost or quality). The three cases are:

1. Value engineering. When the client accepts this suggestion, both receive part of the saved money in a contractually fixed proportion, like 50/50.
2. Higher quality as demanded. If the client sees an advantage and accepts the suggestion, both should agree about a bonus for the contractor.
3. Faster project delivery. If the client sees an advantage, both parties have to agree about a bonus for the contractor.

During the development of the guideline in 2005 to 2008 it was the only way the participants saw to use the knowledge of the contractor in the boundaries of public regulations (Spang & Riemann, 2011).

The first findings in using this method are positive. Especially the first case, the value engineering, is well used. Through its application the client was able to save money by getting the same quality and the contractor could realize a bonus for bringing in his knowledge – the perfect win-win situation.

CONCLUSIONS

Early Contractor Involvement is used in many countries around the world. The ways of involving the contractor and the experiences are quite similar. With these models the time of delivery and the tender costs could be lowered, the changes during the construction period decreased and all of the parties involved got a better understanding of the whole project, which also leads to a higher flexibility and more innovation. All in all the quality of the whole project could be enhanced. These benefits are exactly the points which were criticized in the German construction industry by clients and contractors during the mentioned field study. But implementing the Early Contractor Involvement especially in public financed infrastructure projects in Germany like shown in the model from Australia is not applicable at the moment. Reasons are to be found for example in the strict policies of public funding and tendering. The only possibilities to use the knowledge of the contractor and to motivate him to look for innovation in public financed infrastructure projects are the ‘Funktionsbauvertrag’ and the PPA-Model. These are first steps, but involving the contractor much earlier during the design phase would lead to higher benefits because the costs can be better influenced in this stage of the project. Further research in this topic is in progress by a research project. Its aim is to find new ways to involve the contractor earlier in the planning phase of publicly financed infrastructure projects in Germany respecting the strong regulations for public projects. For this it is analyzed, whether one of the foreign models can be adopted with some changes in it, or if a new model by using the best practices from all of the investigated ones can be set up. Moreover, after finishing this research project, further research is necessary in collecting information concerning the usability and maybe further development of these models.

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A FEASIBILITY STUDY OF BEST VALUE IN ITALY

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ABSTRACT

A variety of business models for performance and quality are being proliferated in the construction and services industry. In Europe, specifically in the Netherlands, the Best Value (BV) business model is being applied and is having positive impacts, making it further attractive to countries that are new to BV and looking for improvements. A feasibility study of BV in Italy is conducted via: a brief synopsis of BV, a resource and environmental analysis, and presentation of the results of a survey carried out to determine the degree of achievability of BV in Italy are analyzed. The feasibility regarding the approach to implementation of BV is also discussed. The results of the industry survey are analysed to understand the overall contracting environment and hypothesize on the potential outcomes of the utilization of BV in the Italian construction and services industry. A list of recommendations to utilize BV is developed.

Keywords: Best Value, business models, feasibility study, Italy, performance

INTRODUCTION

Despite technical advancements such as Total Quality Management (TQM), Lean principles, Six Sigma, Building Information Modelling (BIM), and other Supply Chain Management (SCM) developments, the construction industry has continued to have performance issues. The main observed barriers to achieving increased performance via these models are individual and organizational resistance to change, unsustainable approaches to implementation, and poor economic times resulting in a realignment of expectations (Sullivan 2011). In Italy, the performance of the construction and services industry has not noticeably improved, with construction investments on the decline since 2009, and being hindered by factors such as excessive public debt and deficits, lack of flexibility, considerable corruption and conflict of interests in public procurement and administration (GI 2010), high taxes (World Bank 2010), and bureaucratic procedures (Bevini 2011 and USCS 2011). A new model, the Best Value (BV) business model is being proposed to the Italian

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construction and services industry to aid in the identification and achievement of performance improvement opportunities**.** After the USA, the Netherlands is the country where the BV process is being carried out on the largest scale. The process is being utilized in both private and public sectors, and in a variety of disciplines (Van de Rijt and Witteveen 2011). The application of BV in the Netherlands can provide many good lessons learned for the international application of BV beyond its original USA foundation. The main questions regarding the feasibility of the BV business model in Italy immerged as: 1) Could BV be beneficial to Italian projects? 2) What are the main barriers to BV implementation? 3) What is the most sustainable implementation approach of BV?

METHODOLOGY

A feasibility study aims to identify the following progression (Haramis 1992; Palvia and Palvia 1988): 1) needs analysis of the user; 2) relationship of proposed system to existing or similar systems; 3) environmental analysis; 4) resource analysis; and 5) evidence of the user's ability to react positively to the proposed system and associated impacts. The approach to measure the feasibility of the BV model in the Italian construction and service industry begins with a synopsis of BV, a resource and environmental analysis, followed by a presentation of survey results of Italian construction and service industry professionals designed to measure the industry's receptiveness to BV concepts, and finally an analysis of the results of the survey to determine BV's degree of achievability in Italy. The feasibility regarding the approach to implementation of BV is also discussed. A list of recommendations regarding future implementation of the BV model in Italy is further developed.

Proposed System

Based on the idea that the overall Italian market could benefit from a new, transparent performance model, the BV business model is proposed as a new way to deliver services, run organizations, and optimize supply chains (PBSRG 2012). While other trendy models such as Total Quality Management, LEAN, and Value for Money focus individually on quantitative assessment, design, and vendor-driven approaches, BV is more of a holistic management methodology and can also have quantifiable benefits via performance information measurement tools (NAO 2004 and Sullivan 2011). The BV model's basic tenants include transparency, accountability, and proper pre-planning (Kashiwagi 2011).

The BV model divides a project into three phases: 1) selection; 2) pre-planning; and 3) management by risk minimization. In the selection phase, the main purpose of the BV model is that vendors are given an opportunity to differentiate themselves from other vendors and clients are given the tools to properly select a vendor based upon their overall value of price and performance. Some of the important tools in this phase are the risk assessment and value added plans. In the pre-planning phase, vendors are required to create a pre-plan of their overall execution based upon their original proposal. The final phase of award and measurement is where the vendor tracks and reports all deviations to the contract in terms of cost, time, and overall satisfaction to the client. Lastly, the client completes a final satisfaction survey as part of the project's closeout (Kashiwagi 2011 and Sullivan 2008).

RESOURCE ANALYSIS

The Italian market is constrained in terms of cost, time, and satisfaction, similar to the global market. The barriers of BV implementation are not necessarily limited to one particular country's challenges; rather, challenges identified in the Netherlands' and

Botswana implementation are quite similar to Italy (Kashiwagi et al., 2008 and Van Leeuwen 2011). The challenges observed in Italy are not a result of legislation or technical capability; however, a clear understanding of the current legal environment is necessary to develop a complete feasibility study.

Legal Context

Selection methods and criteria in the European Union (EU) Public Procurement setting must take into consideration the EU legal directives and decrees of the member countries. The Italian Public Procurement Code, approved by Legislative Decree April 12, 2006, no. 163, brings together all the provisions governing contracts above and below the EU threshold with exceptions. The most pertinent are Directives 2004/17/EC and 2004/18/EC that establish selection and award criteria (PPN 2011).

BV Compliance with EU Directives and Italian Code

There are two selection criteria for Italian Public Procurements: lowest price and most economically advantageous tender (M.E.A.T.). The lowest price only criterion is in direct opposition to the BV business model, therefore the M.E.A.T. criterion is more compatible with the BV model. For 86.6% of works contracts the contracting authorities have used the lowest bidder criterion (AVCP 2011). It has been observed that contracting authorities have been struggling with determining award criteria that add value and at the same time meet all legal requirements of M.E.A.T. for many years. As a result these award criteria become minimum quality levels of performance and no dominant differences in quality levels are found between the tenders offered (Pietroforte and Tangerini 1999). The Netherlands' implementation of BV has uncovered some main conclusions about the application of BV tools in the European legal system (Van Leeuwen 2011). First, with regard to selection and award, past performance information can be used in a tender, but should in principle be used as a contractor selection criterion rather than an award criterion to avoid legal problems; risk assessment plans are commonly used as an award criterion; and interviews can also be used, while ensuring objectivity and equal treatment. Finally, if the pre-award period is used before awarding the tender, the main aspects of the contract, such as price and risk allocation should not be discussed.

SURVEY

A survey was designed for measuring Italian industry professionals' perceptions towards the current construction environment, and their receptivity towards BV concepts, to contribute to the feasibility study for BV implementation. The survey was composed of fifteen conceptual questions and was distributed to over 50 Italian construction industry professionals and organizations identified as having Project Management functions in Italy via social networking sites, conferences, and personal emails from March to May 2012. The survey received 389 respondents, which exceeded the required response rate according to Cochran's categorical method (margin of error 7% and 95% confidence level) (Bartlet et al. 2001). Respondents were asked some background information and to rate BV conceptual-based questions on a scale of (1-10) with "10" as strongly agreed and "1" as strongly disagreed. The criteria related to Information Measurement Theory concepts, the Kashiwagi Solution Model, industry perceptions, and BV overall as promoted by the Performance Based Studies Research Group (PBSRG) (Kashiwagi 2011).

Background Data

Survey respondents were primarily designated as Professional architect/ engineer/ technical services/ designer (89%), Consultant (6%), Vendor/Contractor (2%), with

the remaining in Owner/Investor, Government, and the University sectors. The average number of employees in the respective companies was 16 and the average number of projects per year was 336. The average overall reported satisfaction with the Italian construction and services industries was low, rated as 4 (on a scale with "1" being dissatisfied and "10" being highly satisfied).

Results

The survey measured a high degree of receptiveness of the BV model in the Italian construction and services industry (Table 1); however, more education is required prior to implementation. The most commonly contested concepts were: micro-management and control of the vendor by the client are not important to the success of the project, the reliance solely on minimum standards can lead to a lower realized quality outcome/product, and third-party involvement in a project is not necessary for clients to obtain their objectives. These concepts are important to the success of future implementation of BV in Italy. As survey participants were uneducated in BV concepts, future implementation should first begin with education to assist participants in understanding and target the identified areas of contention.

Table 1 – Survey Results

No.	Criteria	Optimal	Agree 10-8	Unsure 4-7	Disagree 1-3
1	An individual cannot control nor change the outcome of a project or an event.	10	15%	48%	38%
2	When an expectation does not match the outcome, not enough information was available and used.	10	45%	47%	8%
3	Management and inspection are very important to the success of a project.	1	49%	38%	12%
4	The person who has a high level of information makes fewer decisions and control.	10	17%	33%	50%
5	The person who has a low information level takes risks and uses management instead of leadership.	10	25%	52%	23%
6	The less control and management the owner does the more risks are shifted to vendors.	10	44%	38%	19%
7	Standards actually cap the highest possible quality an owner could achieve.	10	44%	44%	12%
8	Performance measurement is not beneficial	1	9%	41%	51%
9	Owners need to hire a separate party to represent their needs and to manage the vendor and ensure technical requirements are met.	1	51%	35%	15%
10	The owner should never give their budget to the vendors.	1	27%	33%	41%
11	A manager should feel comfortable minimizing the amount of control and inspection they perform.	10	10%	40%	50%
12	A manager should feel comfortable measuring themselves (in terms of performance).	10	41%	47%	12%
13	The current environment of construction industry is "win-win."	1	12%	70%	18%
14	Low bid is an environment of high competition, low performance, causing change orders, leading to higher prices.	10	81%	16%	4%

FEASIBILITY OF APPROACH

As previously discussed, BV is being successfully applied in an international industry environment by the original implementers, PBSRG; however, it has yet to be sustained in another academic environment, domestically or internationally. As the third and final question of feasibility, the approach to implementation must be

analysed. The approach taken by PBSRG at Arizona State University (ASU) has been described as "out of the box" (Kashiwagi et al., 2008) and requires further explanation.

Historical Barriers

Traditional construction management academic research funding does not have access to owners who are willing to turn over their delivery of services to academic researchers. PBSRG uses the deductive and dominant logic of BV to convince owners to adopt the BV model, and to become partners in the development of the process (Kashiwagi 2011). This type of approach is challenging to undertake given the observed barriers; however, these barriers are not only limited to Italy (Kashiwagi 2011 and Kashiwagi et al., 2008 and Mselle et al., 2009). The main areas of differentiation from other academic research groups and in PBSRG's approach and methodology have been uncovered as (Kashiwagi 2011 and Kashiwagi et al., 2009 and Kashiwagi et al., 2008):

- Application of the model is on active industry projects - PBSRG runs simultaneous theoretical research, prototype testing, and implementation testing, minimizing the time to see results, and having quick access to hypothesis and test results. The BV model has been tested on more than 975 procurements in $4.6 billion in procured services and construction.
- Logic is not pedagogical - PBSRG is using deductive logic (observations), common sense, and dominant information, instead of inductive logic (exploratory work and the heavy dependency/use of industry expert opinion). As needed refinement for dominant improvements are made.
- Results are impactful - PBSRG and the vendors measure the project results of cost, time, the project management/risk management effort, and satisfaction throughout the project, and record all deviations. Documented fewer vendor-caused deviations, increased client satisfaction, and continuing industry demand.

In previous BV implementations, it has been observed that most often academic research is struggling with a structure that can introduce change, and to provide solutions to the construction industry's problems (Kashiwagi et al., 2009). Similarly, research barriers have been observed in the areas of: the university system, resistance to change, and deficient planning (Van Noorden 2010 and Kashiwagi et al., 2008 and Kashiwagi et al., 2009). In the university system, the research drivers are to publish papers, not to test hypotheses, there is low industry involvement overall, and funding is based on this approach (alternative approaches are unsupported). Furthermore, large organizations (professional and academic) are resistant to change when there is no perceived problem or need. Lastly, the environment is reactive and follows industry "trends" and perceived new systems.

Observed Barriers

In order to promote the education of the BV model and to test its feasibility in Italy, over fifteen educational sessions were held and industry groups were approached, educated, and given proposals for the implementation of the BV model in their projects. Despite overall positive feedback, none of the industry groups responded to further communications or expressed desire to collaborate with the research group. In working with the Italian industry, the research group observed barriers in the areas of: operations/administration, lack of perceived benefit by the industry, language, and culture. Under the current operations and administration, research groups have difficulties approaching clients. Secondly, the notion is that the industry has no desire

to collaborate with research groups. Furthermore, at times private companies may not communicate adequately in English and tend to focus on translation differences. Culturally, it is perceived that models originated in America can be seen as only appropriate to American culture. Lastly, research groups have a different approach and mentality than the industry; industry professionals have more project experience.

CONCLUSIONS

The original research questions in the feasibility study can thus be addressed and the recommendations regarding future implementation of BV in Italy are given.

Question 1: Could BV be beneficial to Italian projects?
Yes, the background analysis of the Italian market revealed that the Italian market is experiencing challenges and Italy could benefit from a holistic model that promotes transparency, accountability, and pre-planning. As a current implementer of BV, the Netherlands is the closest comparison as a fellow EU member state.

Question 2: What are the main barriers to BV implementation?
The resource analysis proved that the BV model is not illegal or lacking applicability; rather, a lack of alignment with BV concepts at the organizational and individual levels would be a barrier. The survey uncovered the topics needing education in the future. Therefore, the main barriers to BV implementation are in the education of the model and the degree of sustainability of the implementation approach.

Question 3: What is the most sustainable implementation approach of BV?
The feasibility study regarding the approach uncovered individual and organizational barriers of the implementers (and academic), resistance to change, and deficient planning, presenting imminent challenges for the research group in this academic system. In order to work towards overcoming these challenges, any group seeking to implement BV must completely understand and measure these in the proposed strategic plan prior to implementation.

Recommendations
While BV has proven to be beneficial in international markets, the key to increasing implementation is utilizing the model on projects and documenting the results. In Italy, BV could provide benefits and has the potential to improve performance based upon the feasibility study. Proper strategic and implementation plans should first be devised prior to implementation and follow the subsequent sections.

Strategic Plan
Future collaborators (academic and professional) must have a desire to change the industry and research paradigm within their own means and adopt the concepts of transparency, accountability, and proper pre-planning in their operations. All interested parties must first recognize and map out the barriers and be committed to challenging their own operations. Following is a suggested action plan:

1. Analyze the environment and effects of aforementioned barriers: 1) university's (or organization's) system; 2) change resistance; and 3) difficulty to plan.
2. Create a plan with the research group (or organization) and review with PBSRG and document the areas that need the most attention
    a. Host educational sessions for research group (or organization) and industry
    b. Identify a client with pilot projects for BV utilization
    c. Run a BV project with PBSRG assistance, potential tools: risk assessment plan, value added, interviews, pre-award document, and weekly risk reports
    d. Document the deviations

e. Create a summary or case study
f. Create a plan with interested clients

3. Execute the plan and document the deviations

Implementation Plan

Over the past 17 years, BV testing has followed this progression for implementation (Kashiwagi, 2011):

1. Identify an owner/buyer who wants to increase their value and decrease their risk, cost and transactions on a delivered service.
2. Use the hypothesis of the deductive logic with the goals of minimizing client management/transactions, help the client do more with less, measure vendor performance (and deviations), and identify the source of any deviations.
3. Run a procurement test, using the "latest" BV structure.
4. Document the source of all project deviations.
5. Analyze the test results. Identify problems that could be further minimized.
6. Make the modifications in the BV system, and run another test.

The BV business model can be applied on Italian construction and service industry projects to provide benefits; however, it is dependent on identifying both an academic and an industry group that is able to surmount the challenges and barriers identified in this feasibility study. Additionally, it is suggested that potential implementers follow the list of recommendations, strategic, and implementation plans regarding future implementations of the BV model in Italy. At present, research is being carried out to continue to identify areas of potential implementation in Italy.

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A NEW APPROACH TO CONSTRUCTION ITEM PRICING

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ABSTRACT

The competition for work between contractors is largely determined by lump sum prices for whole projects. However, most project contracts are instead governed by the unit prices for each of the project components. These item prices are more difficult for clients to assess. Translated, this means that contractors have considerable scope within which to decide their prices without effecting their competitiveness and without being noticeable by clients. Research on mathematically optimising these prices started 50 years ago but this has so-far failed to address the risks involved, despite widespread acknowledgement that these risks are considerable. A new component unit pricing (CUP) theory has now been developed that has identified and assessed these risks. This gives contractors prospect by which to decide prices that are in accord with the market – by which they can not only earn more profits but avoid risks as well.

Keywords**: b**idding, operational research, price, risk.

INTRODUCTION

Construction projects are typically competed for by way of project lump sum prices. These bids are easy to compare but they do not provide a basis by which these contracts can be administered. For this purpose, contractors are also typically having to submit sets of prices for each of the constituent items within the project. These will, in turn, add up to their overall project prices. The item prices provide a basis for determining (a) interim payments, (b) valuations for variations, and (c) any escalation compensation that might be offered for inflationary increases in costs. It is, however, very difficult for clients to assess and compare the sets of prices from different contractors (Skitmore and Cattell 2012). This affords contractors a fair amount of scope when pricing items (regardless that the composite project prices are, instead, heavily bound by competitive constraints on account of being so easily compared, at a superficial level).

Contractors can use this scope by which to deliberately price items such that they will enjoy (a) an improved cashflow, (b) more favourable valuations for anticipated variations, and (c) improved escalation pay-outs (if these are provided in the

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contract). It is easy to envisage simple cases (such as those initially used by Gates 1967) in which contractors can accomplish any one of these objectives in isolation but more difficult to imagine (1) how the pursuit of any one of these objectives does not detract from the others, and (2) how they might optimise this, especially considering that contracts can comprise thousands of items. Furthermore, these prices are logically having to be governed in some manner and cannot be decided on without some form of constraint. At the extreme, it is obvious that negative prices would, for instance, be ridiculous! Similarly, to have exceptionally high prices on those items that are to be built in the early stages of the project and to price all other items at close to nil would be equally unacceptable.

This complexity should not distract from the importance of this process and the substantial incentive for "getting it right". A test on a hypothetical project (explained in Cattell 2012b) indicates that a contractor could improve their profit by around 150%, without substantially changing their risk. This analysis was done compared to the benchmark comparing a simple scenario of "balanced prices" in which the prices are, instead, decided on the basis of using the same mark-up applied to all of the items' estimated costs.

Some researchers (see, for instance, Arditi and Chotibhong 2009) are of the opinion that contractors are obliged to only submit "balanced bids" and that it is unethical if they do not. Cattell (1987) has, however, argued that there is no such ethical obligation and that it is instead reasonable to expect that contractors should not attempt "excessively abnormal" and "abusive" pricing but that this is not to be confused with "unbalanced" pricing. Contractors with unusual costs might, indeed, have need to unbalance their prices specifically in order so as to make these acceptable (rather than expose the client to their unusual costing aberrations).

Various attempts (starting with Gates 1967 and Stark 1968) have been made to optimise item prices, since Gates (1967) first suggested that this was possible almost 50 years ago, and these have become known as "unbalanced bidding models". These have suffered from some flaws that have caused them not to be used in practice and yet it has often been commented on (Green 1986) that unbalanced bidding has become the norm and is widely practiced, albeit without the benefit of any mathematical optimisation.

A new approach is now being suggested that overcomes the flaws prevalent in the prior models. This suggests a basis for a scientific method of maximising *utility*, taking account of both the pursuit of profits and the risk that these might not be realised.

THE FLAWS IN PRIOR UNBALANCED BIDDING MODELS

A comprehensive assessment of the prior models is provided by Cattell (2007). The greatest flaw in these models has been that they have not adequately taken account of the (substantial) risks involved. They have recognised that there are risks but they have not been defined, let alone quantified. Universally, they adopted only one mechanism to contain risk: imposing upper and lower limits on the prices of each item.

This approach suffers from two flaws. Firstly, none of this research suggests any method by which to decide these pricing limits. This becomes more significant in light of the second flaw: by way of the linear programming (LP) modelling typically

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being advocated, all of the items barring one, are simply effectively assigned either of these imposed maximum or minimum prices. The models roles, in effect, do not help to identify optimum prices (as one might expect *within* these bounds) so much as rather to simply identify which items to price high and which to price low. These high and low prices play lead roles that are seemingly beyond that which was intended. The use of sophisticated LP modelling simply to split a project's items into two divisions appears inappropriate when there is nothing similar as scientific guidance being advocated by which to decide the pricing limits that play such a significant role.

THE RISKS IN ITEM PRICING

Item pricing has been found to induce three types of risks: the risks of *rejection*, of *reaction* and of *being wrong*.

Risk of rejection

Exceptionally extreme and unreasonable prices can likely be expected to induce criticism from the client, to the extent that this may lead to the client rejecting the contractor's participation overall. There can, for instance, be little doubt that clients would reject the pricing from a contractor in the event that it were so extreme that the contractor only priced one item and no other. If one is working within the scope of more likely scenarios, it is more difficult to predict the client's response but, nevertheless, one can do better than imagine that it is appropriate that there should be pencil-thin boundaries such as the previous style of upper and lower pricing limits. It appears more reasonable to assume that the odds of rejection will be worse as any single price becomes more extreme, without having to draw any single line of limitation.

It has been identified that this risk for any item resembles the 'tea-pot' shape shown in Figure 1. The skew of this curve is explained by way of the risk of low prices, as they get close to $0, being more easily assessed than the risk of high prices. Any single exceptionally low price will highlight to clients that the bid is, overall, an unbalanced one. The client will realise that, corresponding to this low price, other prices will likely be loaded high, even if these are less easy to detect. If a client is sensitive to unbalanced bidding, as suggested by Arditi and Chotibhong (2009) and others, they have as much cause to reject a bid with obviously low prices as they have to reject high prices.

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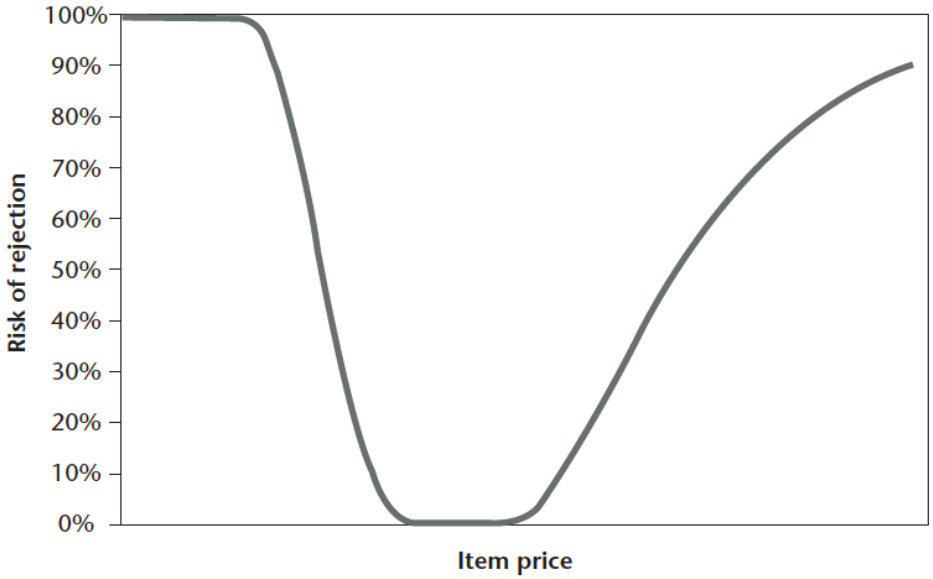

Figure 1 – The risk of rejection for a typical item (Cattell, 2012b)

In terms of quantifying this risk, note that the risk does not amount to the loss of the entire profit that the contractor is hoping to accomplish from this contract. Rather it is accountable to the delay before the contractor will be able to win the next one, and the differential in profits between the two, as well as the cost of having to invest in this additional bidding effort. Notice that if the contractor realises that they have made a mistake with their pricing of a project, especially once they become privy to the prices from other contractors, they might even have incentive to want to induce the client to reject their bid. Figure 2 shows the risk in dollar terms. The overall risk is not additive for all of the constituent items seeing as any one item's extreme price could be judged sufficiently abusive as to trigger an overall rejection. Thus, the overall risk is considered to be equal to the greatest of the risks resulting from each of the items.

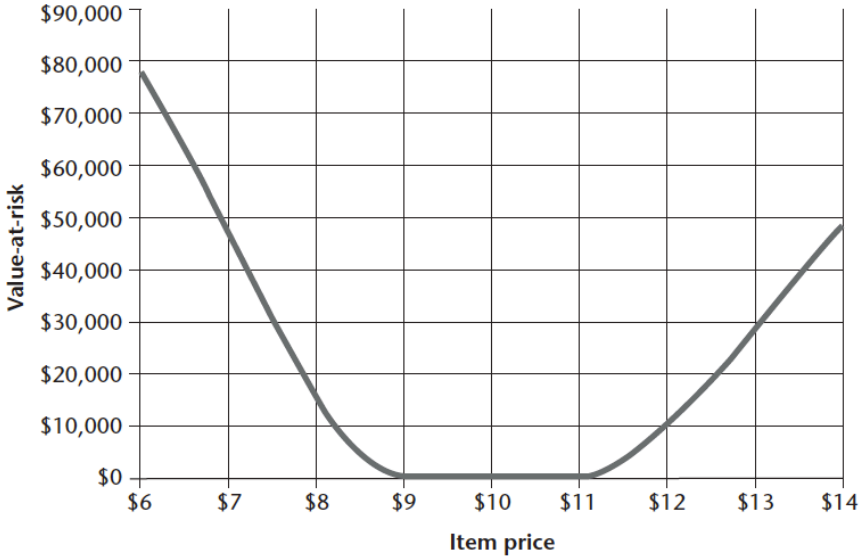

Figure 2 – The risk of rejection for a typical item (Cattell, 2012b).

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Risk of reaction

Besides risk of an outright rejection, there is also a risk that clients may *react* to a contractor's prices. The client could accept the contractor's prices but then adjust the project accordingly. If, for instance, the contractor has priced a particular finish especially high, and if their prices for an alternative finish are attractively low, the client might take advantage of switching from the expensive finish and substituting it with the cheap one. Contractors are, therefore, taking a risk if their prices appear abnormal – to the extent that the client is able to grasp such situations. From the client's perspective they will only be able to assess prices relative to 'normality' prevalent across the industry, and not relative to any secret knowledge that the contractor has of their own costs and cost estimating methods.

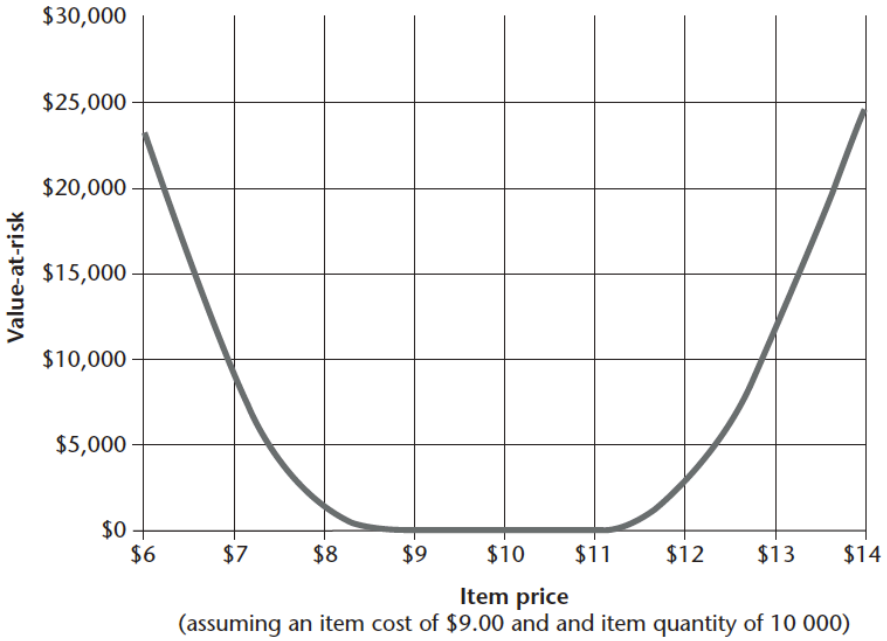

Figure 3 – The risk of reaction for a typical item (Cattell, 2012b)

The risk of reaction amounts to being a risk of erosion of the profits that would otherwise be enjoyed if the client were not to redesign the project.

Risk of being wrong

Cost estimating and item pricing are processes fraught with many unknowns. The contractor is having to decide their prices on the basis of their estimates and assumptions and many of the factors involved will finally be different from that which was anticipated upfront. This uncertainty amounts to being a risk: conceived as a 'risk of being wrong'. In some projects that are inherently of greater risk than others, or in which a contractor has invested less in the process of preparing their prices, the contractor may have great cause to be more conservative with their pricing. If a contractor instead prices an inherently risky project with extreme prices, they will accentuate their risk. If they, for instance, price excavation work extremely high or extremely low and the final quantities land up substantially different from the BQ, the contract will be subject to a more substantial adjustment (either in favour of the contractor or not) than if they had adopted more moderate pricing.

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Value-at-risk metric

This analysis of risk shows that the risks are of two different forms: the one ('direct' form of risk) being induced by way of item prices, and the other ('indirect' form) not. In both cases though, a more conservative spread of prices will lead to less risk than will more abnormal prices. Such pricing though doesn't promise as much prospect of profits as more extreme pricing which therefore presents a classic economic decision: having to weigh up the merits of ambitiously striving for the hope of more profits or reining this in for reason of concern of the risks involved. If the contractor can be equipped with quantified assessments of their profits and risks across their full spectrum of pricing alternatives, they will be able to decide their item pricing with all the sophistication employed in the mainstream world of financial investments.

These two different forms are not easily additive: the indirectly risk being typically measured in terms of variance, and the direct risk not. However, the Value-at-Risk (VaR) method (see Benninga and Wiener 1998, and Kolman *et al.* 1998) of expressing risk provides a mechanism by which to accomplish common ground. Figure 4 shows how the risk of being wrong can be assessed at any particular price point: showing that there is a 100% chance of the possibility of a small loss and increasingly less chance of greater degrees of loss. With adequate data, similar charts could be established for each possible price. At higher prices, given the inherent uncertainty, the more that they will have at risk. Figure 5 shows how this can be made to translate across a spectrum of prices, given a particular probability.

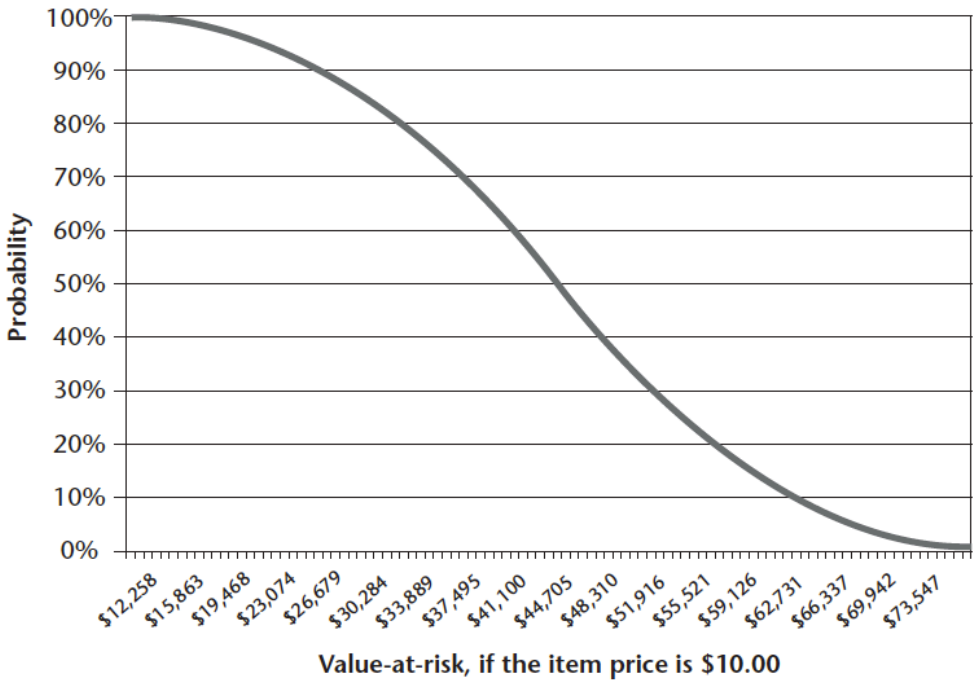

Figure 4 – The risk of being wrong, for an example item, showing that a contractor may be 100% confident of being at risk of making a small loss at a particular price, and increasingly less chance of losing higher amounts (Cattell, 2012b)

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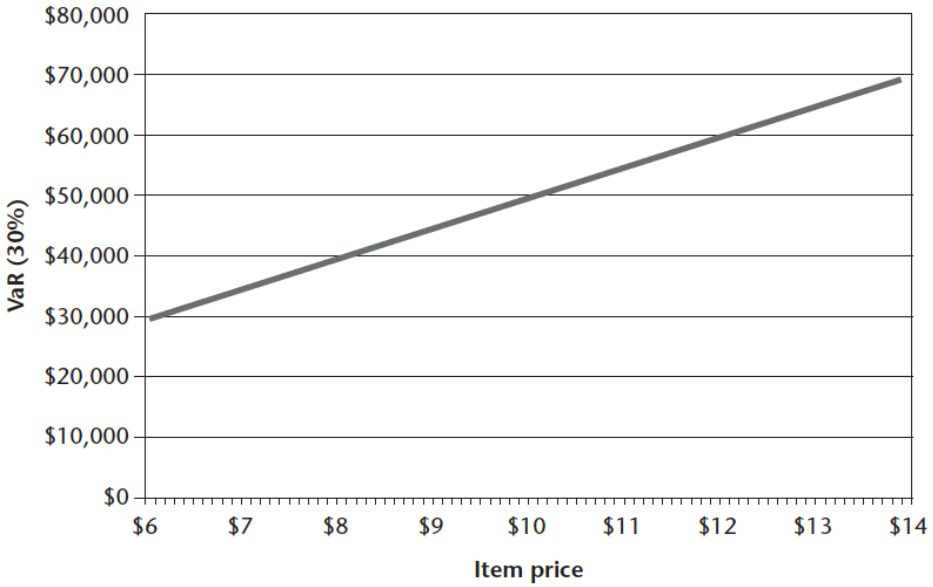

Figure 5 – The risk of being wrong, given a probability, across a spectrum of prices (Cattell, 2012b)

Combined risk

This analysis provides the mechanism by which to determine an overall combined assessment of risk for each item, across their pricing spectrum – see Figure 6 as an example. Furthermore, Component Unit Pricing (CUP) Theory provides the basis of assessing the profit benefits across this same spectrum of choice. Combined, the contractor then has a basis by which they can assess their *utility*, recognising the trade-off between profit and risk according to their personal attitude towards taking on risks.

However, the challenge is made more complex when one considers that these decisions cannot be made on items independently. All of a project's items are integral parts of a combined whole, and any high prices assigned to some items have to be met by low prices being decided for other prices, so that as a whole, the item prices equal the project price.

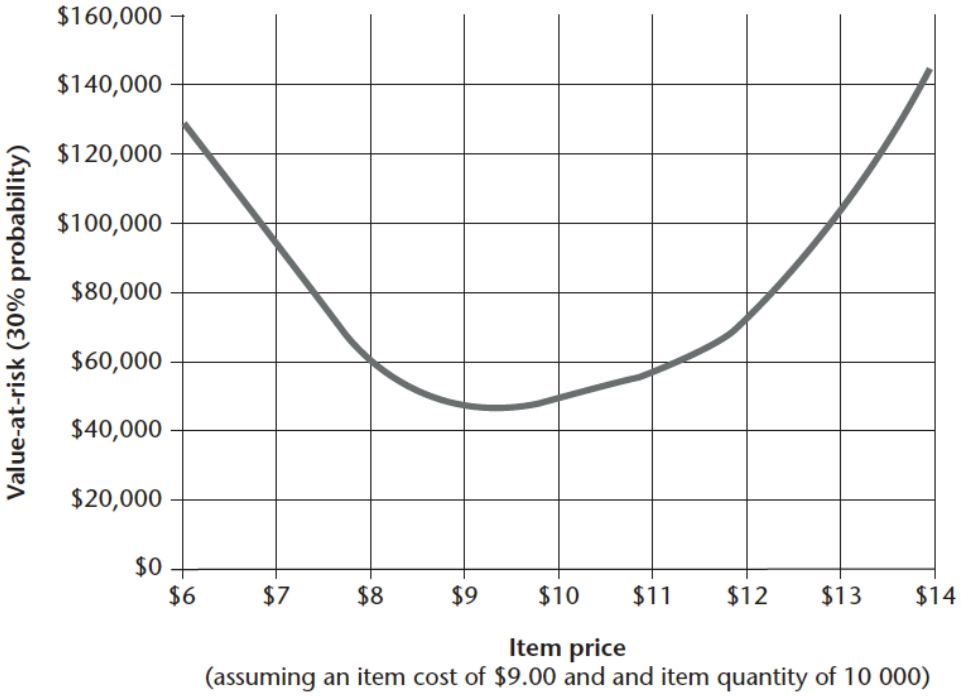

Figure 6 – An example of the combined risks across a spectrum of prices for an item (Cattell, 2012b)

A TEST OF CUP THEORY

A test has been done using hypothetical data for a small project (Cattell, 2012b). It has shown that the contractor's profit from a project could be increased by around 150%, without any appreciable change in risk, relative to a scenario of balanced prices. Interestingly, all the prices identified as being optimal all fall well within the ranges described as being considered normal for that nature of work within the industry. Specifically, the system is designed so as to accomplish pricing that is appreciably normal and not extreme. Furthermore, CUP Theory now provides a scientific basis by which contractors with a great appetite for risk can identify those prices that fall further away from the central norm (whether these are on the high or low end of the spectrum, depending on the nature of the items and what they have to contribute as benefits to the contractor). By contrast to the earlier models, this new theory ensures that the prices don't simply 'stick' to one or other of an extreme upper or lower limit, regardless of all settings.

CONCLUSIONS

Prior research acknowledged that there are considerable risks arising from the prices assigned to each item. Nevertheless, these efforts failed to identify the specific risks involved and hence also failed to incorporate these into the mathematical models that were identified. The only mechanism that was advocated to address risks was to constrain each of the prices within a range that was somehow to be decided. This approach has now been replaced by CUP Theory which identifies and takes account of the risks. This now provides a scientific basis by which to govern prices so as to not only pursue profits but also avoid risks. There is, however, further research and development required to make it practically available.

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ADDING PRODUCTION VALUE THROUGH APPLICATION OF VALUE BASED SCHEDULING

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ABSTRACT

Customer value is a key goal in the Lean philosophy, essentially only actions that adds value should be conducted. In a transformation view, the basic lean approach is to remove waste, which indirectly increases value (or withstand value lose). Lean Construction acknowledges two different types of value views. Product value, as stated above and value in relation to cooperation in the construction process. Process values are important when it comes to the comfort (physical and mental wellbeing) of the craftsmen cooperating aligned around the same goal of a smooth process and a great end product. By increasing the comfort of the craftsmen their productivity could increase. Furthermore, shared process values decrease the needs of managerial standards, structures, and systems. By means of a questionnaire survey this study investigates the connection between scheduling and the comfort achieved through process values of both engineers and foremen on site. The questionnaire identifies relevant process values, and these are compared to values observed in the scheduling process at three construction cases. The aim is to minimize time usage in the scheduling processes and to increase robustness of the schedule by securing an adherence of the schedule. The results show a lack of focus of the scheduling process' surrounding atmosphere. Process values such as sympathy, kindness, helpfulness, and equality had only minimal attention. In order to foster these "soft" values it was found that hierarchy should be minimized and management should seek towards democratic leadership.

Keywords: Last Planner System, Lean, Scheduling, Values, Waste.

INTRODUCTION

Ohno (1988), one of the fathers to Lean, stated that the total capacity of a production system equals the sum of work and waste. Therefore, in order to increase the work and streamline the production Lean has a partisan focus on removing waste. Lean emphasizes the production as a flow of materials where raw materials are undergoing moving, waiting, inspections, and transformations before it reach the intended shape and function as the final product or construction (Koskela 2000; Koskela 1992). Only transformations add value to the product. All other activities are only expenditures in cost and time and can be regarded as waste. The concept is then to eliminate or

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minimize waste by eliminating the non value-adding activities and streamlining the value-adding activities (Lindhard and Wandhal 2012; Koskela 1992). In order to remove waste you need to know and eliminate the root causes. In Lean theory 7 different sources to waste are identified: 1) Waste of overproduction, 2) Waste of stock on hand,3) Waste of transportation, 4) Waste of making defective products, 5) Waste of processing itself, 6) Waste of movement, and 7)Waste of time on hand.

Lean, which includes Lean Construction, only focuses on the hard and direct observable waste. I relation to Ohne's definition a production system consist of work and waste. Work is often considered to be only the transformation, because it is the output. But as an input, in order to complete the transformation, human production factors are needed. The motivation and skill of the employees are having a huge impact on the output both regarding quality and quantity. Thus humans can affect the capacity of the production system. This is especially the case in construction which is considered a labor intensive industry.

Improved human skills are expanding the capacity of the production system since new knowledge is added. Opposite does improved motivation not ad anything to the existing system. Therefore, improving motivation is an exploitation of capabilities already in the production system and a known approach to minimize waste. Capabilities and utilization is also important in relation to the machines in the productions system. Therefore, the phrase can be generalized to: Waste is not to fully utilize of the capabilities and possibilities in the production system.

As mentioned, Lean's primary focus is on removing waste to maximize the value creation. In fact the production outcome is the same, but value lose is evaded by reduced resource usage. Thus removal of waste does not extend the existing value creation in the production system. Extending the value creation can only be achieved by improving the work to increase the customer satisfaction, cf. Ohne's rule.

Crating value is a fulfillment of the customer demand and requirements. Johnson and Kaplan (1987) defined value this way: "value of any commodity, service, or condition, utilized in production, passed over into the object or product for which the original item was expended and attaches to the result, giving it its value." Creation of value in any production system is achieved by producing what the costumers wants to fulfill the customers' demands and requirements. In construction this value creation has two customers: the next trade and the end costumer (Wandahl 2004a). Value creation is measured in relation to cost which includes the consumption of both time and resources. Moreover, value is determined in relation to achieved benefits and compared to value and cost of substituting and competing products.

Creation of value comes through process, but the values in the process are important for maximizing the human input. Production process values are important when it comes to the comfort and motivation of the individual craftsman on site (Bejder et al. 2008). By increasing comfort and motivation of the craftsmen their dedication and accountability will increase resulting in increased productivity (Singh 1996; Olomolaiye 1988). Accountability is important in the scheduling process where the schedule is founded on commitment which needs to be obeyed. Due to interactions and interdependencies between the subcontractors, the flow of work is dependent on fulfillment of these commitments.

The production process values are a part of the corporate culture which dominates the construction site (Van den Steen 2010). Culture is the social and nominative glue that

holds the, in construction, temporary organization together (Siehl and Martin 1990). The main organization in construction is a joint of smaller organizations from the participating subcontractors. Thus, there is a hierarchy of culture where the individual subcontractor has its own subculture (Hunter and Tan 2006).

Culture is by Triandis (1972) defined as: "an individual's characteristic way of perceiving the man-made parts of one's environment. It involves the perception of rules, norms, roles, and values, is influenced by various levels of culture such as language, gender, race, religion, place of residence, and occupation, and it influences interpersonal behavior." According to Kroeber and Kluckholm (1952), culture is affecting behavior by determining patterned ways of thinking, feeling and reacting. Therefore, since behavior is determined by culture, culture needs to be managed. In construction the overall culture changes since organizations change. Every project consists of its unique composition of organizations and employees which together forms the projects culture. Thus, management of culture is important for ensuring optimal capacity utilization, i.e. optimal output of the production system.

Value Based Scheduling (VBS) is introduced in an attempt to affect behavior through changed culture. The concept is focusing on leadership and the connected process values. The objective is to increase motivation, collaboration, and output by establishing comfort and trust between individual craftsmen. An improved involvement when making commitments in the schedule makes the schedule more realistic. Together with increased accountability and dedication the likelihood for observing the schedule is increased. As mentioned every construction project consists of its own unique culture. Therefore, the values should be determined at project basis to fit the present project. Cultural changes are difficult to accomplish, hence it is important to ensure everyone's support in this change process. It is therefore critical that everyone is consulted and have a voice when the values are determined. This ensures alignment and observance of values from top management to each craftsman, on site.

VBS is a parallel to Value Based Management, where values constitute a supplementary scheduling, planning and management tool (Wandahl 2004b). VBS is a proactive approach to avoid or limit problems related to scheduling. The values form an ethical guideline supporting on site behavior and support and reduce the demands to the existing scheduling system, which at a Lean construction company would be Last Planner System (LPS). VBS increases the reliability of the schedule, because commitments increasingly are kept. Values affect behavior by increasing motivation, dedication and accountability, resulting in an increased probability of schedule observance. Thus the robustness of the schedule is increased.

It is important that the scheduling system supports the determined values. Therefore, the purpose of this research is to determine which values in general are preferred in such a system. Moreover, this research suggests which values a scheduling system is expected to deliver. By fulfilling the identified values and needs the scheduling processes can be improved. Identification of the values is achieved through the following research question:

Which values could be combined with existing scheduling procedures of onsite construction and how can these values support Last Planner System?

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RESEARCH METHODOLOGY

To investigate which values that are preferred in a scheduling process an electronic survey was conducted. The samples in this survey were A) the members of leanconstruction.dk, comprising 16 contractors representing a large proportion of contractors in Denmark B) former students at the MSc in construction management programme at Aalborg University, who present is employed as contractors. The two samples were chosen because respondents, to a greater extent, were expected to know about and have experiences with Lean and LPS. Usage of LPS is important since it is based on Lean thoughts. This increases the quality of the replies and the validity of the survey. In total 192 persons were included in the survey. The questionnaire was completed by: 14 project managers, 17 construction managers, 16 site managers, and 7 foremen. The respondents represent varying opinions and contribute with different experience to scheduling. This secures an unbiased and valid survey.

The questionnaire process takes its outset in the strategy presented in Akintoye and MacLeod (1997). First, an initial invitation was sent out to every participant and after two weeks a reminder was sent out to those who had not yet completed the survey. In total 51 persons completed the survey resulting in a response rate of 27%. In the questionnaire the respondents were asked to rate a number of values in relation to the importance in the scheduling process. The values in the survey were found by reviewing the values represented at a number of partnering projects.

Additional three construction cases were followed see Table 1. At the construction cases LPS had to be applied. Data collection consisted participation in scheduling meetings and observations to capture the production process values. Onsite observations help capturing the context wherein the scheduling is conducted. Focus was on the atmosphere and values which were characteristic at the meetings.

Tabel 1 Data collection at the three case-studies.

	Case 1	**Case 2**	**Case 3**
Contract form	Turnkey contractor	Turnkey contractor	Prime contractor
Site observations	Once every forthnight in total 5 observations.	1-2 times every forthnight in total 8 observations.	1-3 times every forthnight in total 8 observations
Meetings partispated in	Subcontractor, foremen and safety meetings	Subcontractor and LPS meetings	Subcontractor, foremen, emergency and construction meetings
Observation length	10 weeks	10 weeks	10 weeks
Interviews of site-manager	Unstructured and semi-structured	Unstructured and semi-structured	Unstructured and semi-structured

The research presented is a part of an ongoing research project aiming to disclose new parameters to help and support scheduling in construction. The research is explorative and open minded, and is trying through creativity to avoid the limitations of a narrow-minded and traditional way of thinking.

RESULTS

A questionnaire was designed to capture and rate the importance of different values in relation to scheduling processes and the schedule itself. To capture a complete and

nuanced picture project managers, construction managers, site-managers and foremen has been included in the survey. The results from the questionnaire are afterwards compared with case observations from 3 construction sites. Focus has been on how and whether or not the values are supported, encourage, and fostered in LPS.

In the questionnaire the respondents were asked to rate the importance of certain values and to which extend they found it important that the given values would be supported by the scheduling process. The results, which are presented in Table 2, shows a tendency in the construction industry to rate the "hard" values such as responsibility and collaboration higher than the "soft" values such as helpfulness, kindness, and sympathy.

Table 2 "If scheduling should be combined with values to which extend do you think the schedule should encourage [Value]?" When calculating the weighted average: to a very high degree was valued 1000, a high degree 100, some degree 10, lesser degree 1, and not at all 0.

[Value]	**Respondents**	**Weighted average**
Responsibility		643
Respect		534
Cooperation (Willing to share)		530
Honesty		518
Trust		514
Equality		392
Helpfulness		255
Kindness		226
Sympathy		199
Total (N=)	51	

Responsibility turns out to be the highest rated value. Thus it is important that the involved contractors' respect and obey the mutual agreements and, as best as one can, seek to observe the commitments. Therefore, responsibility is a key issue in LPS in the search for increased robustness. Responsibility is together with trust the only values LPS directly seek to foster. In LPS trust lays the foundation to collaboration.

In LPS, responsibility is increased by involving foremen in the Phase scheduling. Participation and joint-responsibility increases the awareness of subcontractors regarding the importance of observing the schedule. Moreover, responsibility and awareness are fostered by the implemented PPC calculation. Basically, PPC is a measure illustrating the percentage of kept commitments, where also trust and honesty comes to a test in relation to the likelihood of commitments being obeyed. Furthermore, joint-responsibility in the scheduling and sequencing does unite the parties and encourages collaboration.

LPS puts only little attention to the atmosphere wherein the scheduling processes proceeds and to the comfort of the individual craftsmen. This was characteristic at the observed cases where no focus was on kindness, helpfulness, sympathy, equality, or respect. It is important to stress that the "soft" values increase comfort. It was therefore, no surprise that one of the three sites was dominated by a harsh tone. This rough behavior was promoted by the site-manager who had a very brutish appearance. Moreover, he used his hierarchical advantage to force through his own agenda and

opinions. His leadership did not at all seek towards equality and did not encourage collaboration, honesty, sympathy, etc. Hierarchy of power was observed at all three construction sites. But in the other two cases the hierarchy was not as direct visible and not used as a management tool.

DISCUSSION

Both the questionnaire and the studies show that scheduling in today's construction only has minimal focus on the values which foster comfort to the individual employee at site, and hence frames an effective working climate. Management should put more effort into ensuring this comfort because it is the breeding ground for motivation and mutual trust. All too often construction sites are plagued by internal competition among the participating trades. In the worst cases this leads the trades to a state of war where the only objective is to maximize own profit, and to sub-optimize in all aspects. Therefore, Lean could be improved by focusing not only on transformations but also at the leadership which guide and support the transformation process to increase comfort and motivations of project participants. The result will be increased efficiency and productivity as well as a more robust schedule.

Production process values should be identified to support the existing schedule system. Values need to be mutual developed and agreed. This will ensure all subcontractors commitment for observance. Common goals and values lay the foundation for the culture at site. It unites and glues the temporary organization together and makes them act as they were one company, cf. Siehl and Martin (1990). Additional long-term cooperation through partnering or joint ventures could form the setting for a united culture. This will improve the scheduling and the encouragement for collaboration will increase. The willingness to share resources to increase utilization and find common solutions will also be expected to rise.

Finally, it is important to minimize hierarchy of power in the scheduling process. Lean should seek towards a flat organizational structure. Here, it is important that all participants should be involved and have an influence in the development of the schedule. This increases the quality of the schedule (Ballard and Howell 1994). Moreover, it increases the motivation by fostering equality, sympathy, and mutual respect.

Construction sites are often dominated by autocratic leadership which, according to Cassel (2008), creates *"ego-centered"* individuals where competition and power drives the motivation. Mutual competition at construction sites is evident and composes a significant problem in today's construction. Mutual competition was observed multiple times during the case studies, and hindered collaboration. Thus is there a need to change this style of leadership. Construction sites should seek to be managed through democratic leadership. According to Cassel (2008) individuals under democratic leadership tend to be social- and group-centered. Moreover the extreme emphasis placed on competition is replaced by courtesy, honesty, and cooperation (Cassel 2008).

FUTURE RESEACH

This research is an initial part of an on-going research that emphasises the human aspect of construction production scheduling. Here, VBS is intended as a support to LPS to increase robustness of the schedule by increased motivation and dedication to the commitments. Additional further research is needed to support the research and to

form guidelines for selection and observance of values and how they can be supported by leadership style. Among others this involves pilot projects to test the theory.

CONCLUSION

Lean does not focus on the importance of humans in the production system and ignores their influence on capacity and quality. Humans do together with machinery and equipment compose the production system. Improving motivation is a utilization of the existing capabilities in the system. In Lean, there is no direct focus on utilization. Here, not fully utilization of the capabilities and possibilities in the production system should be regarded as the 8th source to waste.

If utilization is regarded as waste unnecessary waste could be removed if the motivation and comfort at the employees on site is improved. This can be achieved by focusing on the production process values. Moreover, values form an ethical guideline which influences culture and behavior. By fostering dedication and responsibility the likelihood for observing the commitment in the schedule is increased.

The atmosphere wherein the scheduling process proceeds is important to the comfort of the individual participant. Management should increase their effort of ensuring this comfort because it is the breeding ground for motivation and mutual trust. Therefore, leadership is important. Site management should seek towards democratic leadership because it encourages courtesy, honesty, and cooperation which are key elements in an attempt to improve the current scheduling system. In general Lean should seek towards minimal hierarchy because involvement and influence improves the quality of the schedule and it fosters equality, sympathy, and respect.

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AN EDUCATIONAL APPROACH FOR USING PERFORMANCE CRITERIA IN THE ROOFING INDUSTRY

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ABSTRACT

A roofing materials manufacturing company can evaluate performance of representatives, products and contractors by utilizing Arizona State University's Performance Based Studies Research Group, and their PIPS program,. Service life of the systems can be tracked and customer satisfaction measured. Facilities purchasing a new roof system, can benefit from the information gathered as a guide in making second, value based decisions. Creating a historical, concise and accurate documentation of roofing systems is a benefit to all involved. The procurement process, installation and longevity of the roofing systems can be tracked and graded.

Keywords: performance, procurement, purchasing, roof, value

INTRODUCTION

The task of selecting a roof, roofing products manufacturer and the contractor proves to be one of the most important, and daunting tasks, facing a facilities manager or architect. Aside from the aesthetic and architectural aspects, the decisions are numerous. The considerations are cost, product performance, warranty, professional installation, and project monitoring. This purpose of this paper is to examine the importance of performance information in the delivery of roofing needs in the built environment.

For the customer that is in charge of purchasing a roof, information and the experience of others can be invaluable. Sometimes the case is that the roofing decision maker has no prior experience in roof procurement. They lack information

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necessary about which is the most reputable company, and the best performing contractors. Armed with the understanding of what peers experience can reassure them that their decision is the best that can be made.

Selecting a roof system involves the consideration of numerous factors, including quality, warranty, service, responsiveness and, the biggest one, price. The process is somewhat overwhelming. Their final decision needs to take all the variables into consideration. When presenting to their superiors, the customer needs to have the background information to justify the choice.

Researchers and educators from the Performance Based Studies Research Group, at Arizona State University, administer a procurement process. Their Performance Information Procurement System, or PIPS, provides the research, survey administration and data analysis needed to evaluate a manufacturer or contractor. It gives clients information on which to base their decisions and gives them a solid performance rating of manufacturers and contractors. Their studies enable the executive to make decisions as to reliability of companies and the value they will receive.

As stated on ASU website, "best value procurement system provides an answer to measure output, and minimize risk." (www.pbsrg.com)

The Consideration of Price

Price can be defined as value, or worth, of a product or service. Too many purchasers rely solely on price. In many purchases, value can be sacrificed in the name of price. Be it a large or small roofing budget, the purchaser should expect value for the money spent. Just as the highest price does not guarantee higher value, lower prices do not mean financial savings. The highest price can be an inflated amount to achieve a higher profit margin for the supplying company. The lowest price most often means that there is a lower initial cost but the maintenance, lost time, property damage and delays can add dramatically to the low cost, resulting in an inversion of value.

Hiring a reputable roofing professional gives the buyer an advantage. The best professionals will gather information pertinent to the project. They will determine the needs of the customer as to the roof system usage. For example, the roofing expert can determine, What is the roof protecting? What are their energy savings priorities? What is the effect of the weather/climate in that geographical location? What roof mounted equipment is to be installed? Will the use of the roof be out of the ordinary (such as helipads, heavy equipment placement, venting of grease or chemical vapors)?

The Consideration of Warranties

"Today's commercial roof buyer usually relies on a low price and a warranty to procure their roof purchase" (Fricklas, 1995). These two factors are why roofing is the black eye of the construction trade. The client does not realize that the manufacturer's attorney has written the warranty to protect the manufacturer, not the customer. By accepting their warranty, they give up better protection that they would get through the Uniform Commercial Code (UCC).

The number of lawsuits involving low slope roof systems equals or exceeds the total number of lawsuits filed over all other building systems combined (The Manual Of Low-Slope Roof Systems - (Griffin & Fricklas, 1982). Roofs were the single factor most commonly involved in architects' claims. (D.P.I.C.).

According to the National Roofing Contractors Association (NRCA), "roofing consumers, with the assistance of roofing professionals, should focus their purchase decisions primarily on objective and comparative analysis of proven roof system options that best serve their specific roofing requirements, and not on warranty time frames."

The best measure with which to judge the worthiness of a service provider is to examine their past performance. In order to make an excellent choice in the roofing partnership, it needs to be verified that the servicing company delivers the services promised. The best way to resolve this is by an examination of the company's past projects. History can be an excellent predictor of the future and PBSRG's "PIPS" program can provide this information.

The concerns and key issues are entered and scored in the A.S.U. PBSRG Customer Service Satisfaction Survey. The results show the history and rating of the manufacturer and contractor. The data is confirmed, recorded and analyzed by educational professionals and researchers. This combination of personal experience and accredited certification bodies reinforce the business decision.

Performance Information Collection Tools

Surveys are a common tool in today's business environment. Consumers have begun seeing the advantage of having reviews from their peers on which to base their decisions. It aids them when buying products and services. In years past, consumers relied on publication such as Consumer Reports, The Better Business Bureau, or the experiences of friends and neighbors. Most online retail stores ask customers to fill out a survey form regarding the product that they have purchased. The grades and comments are then available on-line to consumers wanting to purchase these items. It aids in the decision making process by addressing an individual's needs and features desired in a product. The internet furnishes purchasers with reviews by their peers, on a specific product. People are accustomed to availing themselves of this valuable tool. Today's buyers then have comprehensive value expectations and can make informed decisions based on all of the information supplied to them by other people like themselves. They can compare cost, value and service based on real experiences. This demonstrates the confidence that consumers have come to place in the opinions of others. This demonstrates the strength of information used to determine product value.

The Customer Satisfaction Survey is a measurement tool designed to provide an assessment of performance. It strips off marketing while asking 5 questions that are rated on a 1 - 10 scale, and 4 questions that are yes/no. The purpose of this process is to determine the performance of roofing systems and contractors.

Surveys are only as reliable as the agency administering them. The interviewer must be educated and well trained. The information gathered needs to be properly

compiled in order to be of the most value. With the resources and expertise behind ASU's construction division and research group, it makes them especially qualified to provide a comprehensive, realistic and viable report. The beneficiaries of these reports can experience a high level of trust with this prestigious university conducting the nonbiased report.

The data collected from the surveys benefit the consumer. It also benefits the manufacturing company and the contractors. The use of ASU's Performance Based Procurement Model can direct a company's attention to areas in need of improvement. When used nationwide, this program can evaluate the performance by area, manufacturer's representative, or contractor. This allows the company to analyze, and develop a strategy for improvement. A survey will expose the cause of problems in specific geographical areas. It identifies the weak component whether it is the contractor, the rep or a combination. Problems and concerns can be narrowed in on, and measures can be taken correct deficiencies in performance of Company, reps, products and contractors. This can amount to enormous financial savings as the company can focus on problems such as call backs for leaks, rework and warranty claims. The biggest loss is when roofing manufacturers do not perform or respond, and lose a customer.

Case Study – Tremco Inc.

Tremco Inc., established in 1928, specializes in the manufacture and sales of roofing materials and related services. The company participates in the ASU Performance Based Procurement Program and benefits from the surveys.

How Is It Administered?

On a monthly basis, Tremco's Warranty Department provides a nationwide list of completed roof projects to ASU PBSRG with all pertinent contact information. Two demographic groups are used. One group is comprised of recent roof completions; the other group is older installations. The list assigned to undergraduate students who work for PBSRG. The client is contacted, results are tabulated, and a report made available to Tremco.

What Do The Measurements Mean?

The questionnaire focuses on measuring performance (example in Figure 1). Customer survey results are more significant with historical data rather than with only recent installations. A newly installed roof that is free of leaks could be fairly predictable. However, roof systems that are 14-22 years old, and performing leak-free is more impressive in the arena of value.

The customer rating system is based on a 1 to 10 scale, with 10 being the highest. There are 5 questions that require this numerical rating. There are four questions that are yes/no.

Customer Survey Responses

 ISBN: 978-1-84219-840-7 .

Based on 90 responses, totalling almost 3.5 million square feet of roof area, Larry Greenfeld, Tremco Sales Rep in the Phoenix, Arizona area, received the following ratings:

Table 1: Phoenix-area Roofing Performance

Criteria	Rating
Contractor's Performance	
Quality of workmanship	9.4
Professionalism	9.5
Level of honesty	9.8
Response time to emergencies	9.1
Overall customer satisfaction	9.3
Tremco's Overall Performance	
Ability to resolve issues	9.8
Responsiveness	9.8
Ability to coordinate with facility personnel	9.7
Overall customer satisfaction	9.7
Overall Roof Performance	
Customers that would purchase again	99%
Roofs that do not currently leak	99%
Oldest roof surveyed	22 years
Average age of roof	14 years
Largest roof area	260,000 SF
Average roof area	38,570 SF
Total roof areas surveyed	3,471,321 SF
Number of roofing surveys returned	90

Using The Survey As A Sales Tool

The most difficult part of selling a roof system is that the customer cannot see, taste, hear or hold the end product. The raw products do not give them the vision of how well their system will perform. They are in essence, buying "blue sky", and trust that they put in sales representative, the manufacturer and the contractor. Tremco only uses approved contractors that have earned the privilege through their years in the business & financial stability. The survey and their results serve to reassure the customer that they will be getting the quality and value that they anticipate and deserve. The strength and creditability of the results lies within the administration by an independent studies group that does not stand to gain financially by the outcome of the surveys. Administering the program are researchers and educators in ASU's Del E. Webb School of Construction Program, in the Performance Based Studies Research Group. The scores provided by such a prestigious university validates the buyer's decision, reassuring them of the value that they will receive. The survey results are an extraordinarily powerful tool to utilize when attempting to assure a customer to trust Tremco and their products. A presentation to facility personnel begins with a summary of performance results as collected by ASU. Clients are impressed with the excellent scores, and are more open to believing that they too will receive service and value. From this point on they are more convinced that what the manufacturer's rep tells them is factual, and not an empty sales pitch. Every Tremco representative should be availing themselves of this convincing data. The positive grades make their job easier when it comes to selling Tremco's service and products.

Performance Based Studies Research Group
Phone: 480-727-0785 Fax: 480-965-4371
Website: www.pbsrg.com

Name:

Phone: ..... **Agreement:** .....

City: ..... **State:** .....

Subject: Performance Evaluation of: ***(Roofing Contractor)***

(Sales Group Description)

(Sales District)

The PBSRG, at Arizona State University, collects and documents past performance information on contractors and system manufacturers. Tremco is participating in a process identifying the performance of their roofing systems. You have been identified as a client for whom they have previously performed work. We would greatly appreciate your time in completing this survey.

Rate each of the criteria on a scale of 1 to 10, with 10 representing the best (i.e. extremely satisfied) in a particular area and 1 representing the worst, or Y or N, with Y representing Yes and N representing No. Please rate each of the criteria to the best of your knowledge. If you do not have sufficient knowledge of past performance in a particular area, please leave it blank. This is a university survey and your responses will remain confidential.

A. Customer Satisfaction Ratings

Owner Name: ..... **Date Installed:** .....

Roof Type: ..... **Job Area (SF):** .....

NO	CRITERIA	UNIT	Rating
1	Satisfaction Rating of the Roofing System	(1-10)	
2	Would you purchase the Tremco Solution again?	(Y/N)	
	If no, explain *(insert notes here)* -		
3	Is the roof currently leaking?	(Y/N)	
4	Satisfaction Rating of the Contractor	(1-10)	
5	Would you hire the Contractor again?	(Y/N)	
	If no, explain *(insert notes here)* –		
6	Satisfaction Rating of the Tremco Representative	(1-10)	
7	Satisfaction Rating of the Value Relative to the Overall Project Cost	(1-10)	
8	Overall Satisfaction Rating of the Project	(1-10)	
9	Repeat Customer (for internal use)	(Y / N)	
10	Ask if interested / know of Tremco's Additional Services 1. Roof Restoration Options (*Yes / No / Not Sure)* 2. Roof Maintenance Programs (*Yes / No / Not Sure)* 3. Energy Audits a. Basic Energy Audit (*Yes / No / Not Sure)* b. Comprehensive Energy Audit (*Yes / No / Not Sure)* c. Air Barrier Testing (*Yes / No / Not Sure)* d. Thermographic Building Inspection (*Yes / No / Not Sure)*		
11	Notes:		

Figure 1. Performance Survey

CONCLUSIONS

The information provided by PBSRG provides an objective and viable tool for the consumer to choose a quality product and contractor without the distractions of marketing, promises, or a salesman's hype. The impact of this information is that it provides a non-proprietary conclusion that directs the decision maker to a high performance choice.

The surveys used nationally will provide information on who are the highest performers. The results of the study will publicly expose those geographic areas where contractors' installations were defective; it will also expose where manufactures have not met customer expectations.

The results provided by PBSRG help to minimize the risk in selecting a roof system. The fact that such information is available for the owner can reassure them that they are making the right decision. Manufacturers benefit from the information that they receive. It enables them to determine which areas are highest and which are lowest in areas of customer representatives, product, services and support service. With history, durability and life span of the roofing systems installed, value is factually charted. PBSRG is a benefit to consumers, manufacturers and contractors.

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AN INTEGRATED COST MANAGEMENT SYSTEM FOR CONSTRUCTION PROJECT DELIVERY

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ABSTRACT

Cost management is a major discipline in delivering construction projects of different sizes and complexity. In existing cost management systems information is usually produced too late, and is often too aggregated and distorted for use in project management. A review of existing literature suggests that the main problems for the poor performance of traditional cost systems are related to flaws in estimating and cost control processes, inadequate information modelling, and more significantly, the lack of integration of cost management across the whole project. In addition, problem of measurements provided by traditional cost systems not sufficiently linked to the goals and objectives set for project. Traditional cost control processes are also criticized because they simply identify variances by monitoring actual performance against cost estimates. To address these inherent weaknesses in the current practice of cost management, a framework for an integrated system has been proposed which aims to cover the gaps of traditional methodology by integrating the stages in projects' whole life cycle. The current paper outlines the integration methodology that has been adopted in the proposed system. It covers the project stages from inception to operation stage. An alpha version of an applied model derived from the proposed integrated system is presented as a basis for future research.

Keywords: cost control, cost estimation, cost management, project delivery, project management.

INTRODUCTION

Existing traditional cost management systems are mostly based on the same principles conducted ages ago. Cost information is usually produced too late, and it is too aggregated and too distorted to be relevant for project management. (Kern & Formoso 2004). An accurate estimation of construction cost is crucial in construction projects for budgeting, planning, and monitoring for compliance with the client's available

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budget, time and work outstanding. In cost estimation, the experience of the estimator and the project information are significant factors. Therefore, parametric cost estimation models are very useful in the early stage of a project's life cycle, when little information is known about the project's scope. Bottom up estimation technique provides total cost by preparing individual estimates based on the Work Breakdown Structure (WBS) of the project. Today is the most found estimation technique applied in projects because of high level of accuracy. Main disadvantage is the effort which increased together with levels and details in WBS analysis. (Rupen 2009)

As described various cost estimation methods are used today. These are considered as traditional estimation methods and include parametric, analogy and bottom up methods. When choosing a methodology the company or the manager may always consider that cost estimating is a forecast, a projection of future costs based on a logical extrapolation of available historical data. The method or the type of cost estimating method is used today depends on adequacy of project definition, level of detail required, available data and time constraints. (Long 2000)

Identifications of Drawbacks and Limitations

Implementation problems with cost estimation may also include that very often cost estimates are no longer reliable. The failings of the traditional cost management systems have three important consequences. Firstly, such systems cannot provide accurate project cost. Costs are distributed to project in a simplistic and arbitrary way that usually does not represent the real demand of the project itself. Secondly, they fail to stimulate decisions that can affect the overall project result. Finally, the cost management information provided by traditional systems is of little help to managers in their effort to improve project performance.

A review of existing literature clearly indicates that the main problems for the poor performance of traditional cost management systems are related to flaws in estimating and cost control processes, inadequate information modeling, and the lack of integration of cost management. In addition, there is the fact that measurements finally provided by traditional cost management systems are not linked to the goals and objectives set for each project. Ostrenga (1997) argue that cost estimates are not reliable due to oversimplifications made when costs are attributed to projects. By contrast, traditional cost control processes are also criticized because they simply identify variances by monitoring actual performance against cost estimates. Cost projection is usually not taken into consideration. (Kern & Formoso 2004)

The proposed integrated cost management system together with model development application which is investigated in following sections provides a proactive means for project control and seeks to make cost a driver for design, thereby reducing waste and increasing value. Under this new approach, estimation stage and Control stage are integrated and share the same goal of maximizing the performance and the value of the project.

Cost Management Process

The literature review regarding traditional cost management approaches highlights the need to define the process approach to managing beneficially the projects' cost. Horngren et al (1990) regards a costs management system is regarded as a framework for project cost information. Those systems consist of a set of principles, methods and tools whose main objectives are to estimate costs and to generate information in order

to support different managerial decisions during the distinct phases of project. Cost management systems must be dynamic, proactive and able to support different decision making processes, as well as to protect the business from the harmful effects of uncertainty. According to Kim (2002), particularly in the construction industry, cost management systems must include the processes required to ensure that the project is completed within the approved budget. These processes include integration between cost estimating, cost control and cost projection to meet the project targets. The integration system proposed is a complete managerial process, which aims to generate information to support decision making and to stimulate cost reduction, value improvement and continuous improvement in the organization. Cost management systems are understood as being composed of two main processes the cost estimating process and cost control process under an integrated environment (Kern et al 2004)

Cost Estimation Process

The objective of a cost estimating process is to estimate the cost of projects. This requires a thorough understanding of the design, contracts, procurements and construction in order to properly model the sequences and manage the resources of the estimation process. In construction, the cost estimating process usually starts by producing a budget, normally at the very early stages of the project. It is a very important cost document throughout the project's life cycle and is often part of the project main contract. This initial estimate also serves as a reference for cost planning and control. As project cost estimating is a very complex task due to the inherent uncertainty and variability of construction, the cost control process must provide feedback on the cost estimating process in order to improve the quality of information available in the cost database that will be used for other projects in the future.

Cost Planning and Cost Control Process

After costs have been estimated, the financial performance must be planned and controlled during the planning and procuring stage by means of a cycle composed by two sub-processes, cost planning and cost control. Cost planning involves refining the initial cost estimate and generating a project cash flow, based on additional information that is generated along the project, such as schedule of payments for the main material suppliers and subcontractors, which should be based on production plans. This sub-process may support decision making in an efficient way, so as to increase likelihood of achieving project plans and meet project's objectives.
In addition to cost estimating, the process relies heavily on feedback from the cost control process. Plans have to be changed whenever necessary and situations that need special attention must be highlighted. The aim of cost control sub-process is to monitor actual cost performance and identify improvement opportunities, which must be dealt by corrective actions. It should not be limited to comparing current and estimated performance but also focused on the value generation.

Cost Management processes described are used in the project delivery stages from inception to the use stage. Their integration process that this study analyzes will provide a complete integration cost management system with emphasis in the links of these processes and the feedbacks from one process to the other.
Table 1 provides an overview of the project cost management processes and their links integrated in one single system operating as a whole process.

PROJECT COST MANAGEMENT		
1 Cost Estimating	**2 Cost Budgeting**	**3 Cost Control**
.1 Inputs	**.1 Inputs**	**.1 Inputs**
.1 Enterpirse environmental factors	.1 Project scope statement	.1 Cost baseline
.2 Organizational process assets	.2 Work breakdown structure	.2 Project funding requirements
.3 Project scope statement	.3 WBS dictionary	.3 Performance reports
.4 Work breakdown structure	.4 Activity cost estimates	.4 Work performance information
.5 WBS dictionary	.5 Activity cost estimate detail	.5 Approved change requests
.6 Project management plan	.6 Project Schedule	.6 Project management plan
Schedule management plan	.7 Resource Calendars	
Staffing management plan	.8 Contract	
Risk register	.9 Cost Management Plan	
.2 Tools and Techniques	**.2 Tools and Techniques**	**.2 Tools and Techniques**
.1 Analogous estimating	.1 Cost aggregation	.1 Cost change control system
.2 Determine resource cost rates	.2 Reserve analysis	.2 Performance measurement analysis
.3 Bottom-up estimating	.3 Parametric estimating	.3 Forecasting
.4 Parametric estimating		.4 Project performance reviews
.5 Project management software		.5 Project management software
.6 Vendor bid analysis		.6 Variance management
.7 Reserve analysis		
.8 Cost of quality		
.3 Outputs	**.3 Outputs**	**.3 Outputs**
.1 Activity cost estimates	.1 Cost baseline	.1 Cost estimate (updates)
.2 Activity cost estimate detail	.2 Project funding requirements	.2 Cost baseline (updates)
.3 Requested changes	.3 Cost management plan (updates)	.3 Performance measurements
.4 Cost management plan (updates)	.4 Requested changes	.4 Forecasted completion
		.5 Requested changes
		.6 Recommended corrective actions
		.7 Organizational process assets (updates)
		.8 Project management plan (updates)

Table 1: Proposed Project Cost Management process and integration linkages

Proposed Integrated Cost Management System and Applied Model-Alpha Version

It is important that the method used to develop the project budget is precise enough to provide a basis for controlling and monitoring the desired building throughout the detailed design process. A good budget should be supported by established design parameters and quality levels and then priced on a conceptual basis in enough detail to allow the control process to be effective. (Theodorakopoulos 2009). Since the integration has been applied in the proposed system an applied model has been developed which uses the proposed integrated system and its components. The time process of developing a prototype cost management model has been previously described and analyzed in Figure 1. The alpha version of the prototype model is the second step in the time process of the completion of integrated system. The IS development which is currently analysed provides all the necessary tools to parameterize the model into many project categories according to their needs and meeting their project targets

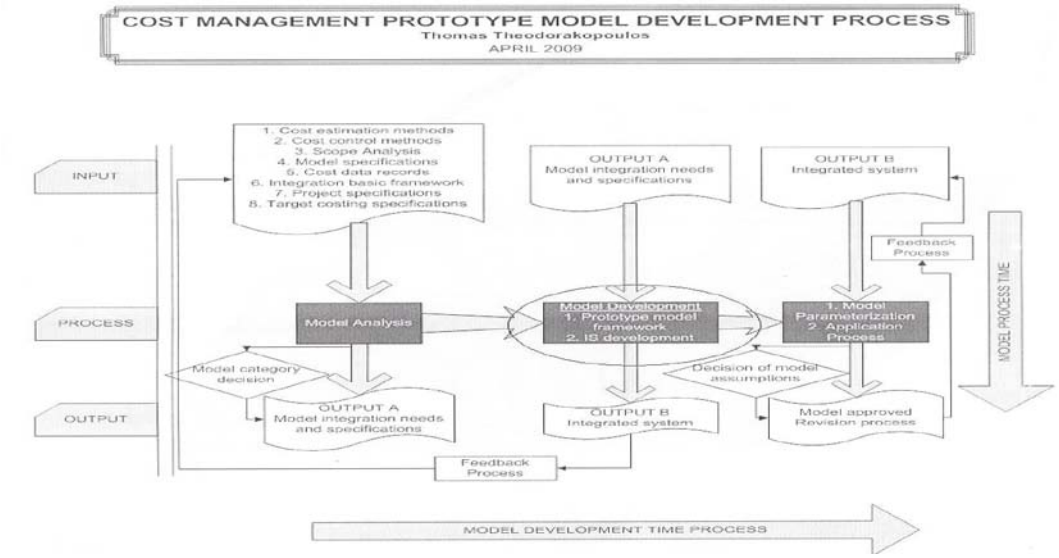


Figure 1: Model Development Time Process Step 2

Model Development Analysis

This analysis uses a generic algorithm which calculates the total project cost according to the cost estimation method chosen and the various project features. This project example describes an activity which is measurable in terms of cost (Theodorakopoulos 2009). The applied model consists of two main components, the budgeting cost database and the actual cost database, both presenting in Figure 2 and 3 accordingly. Both planning and control databases follow the same WBS structure in various levels in a unique ID coding system allowing full integration process between budgeting and control stage.

Figure 2 shows an example extracted from budgeting cost database referred to the budgeting of a bridge construction in phases. Participation weight factors are used in budgeting process depending on the nature of the structure. Hence is succeeded to gain a complete budget for all project activities.

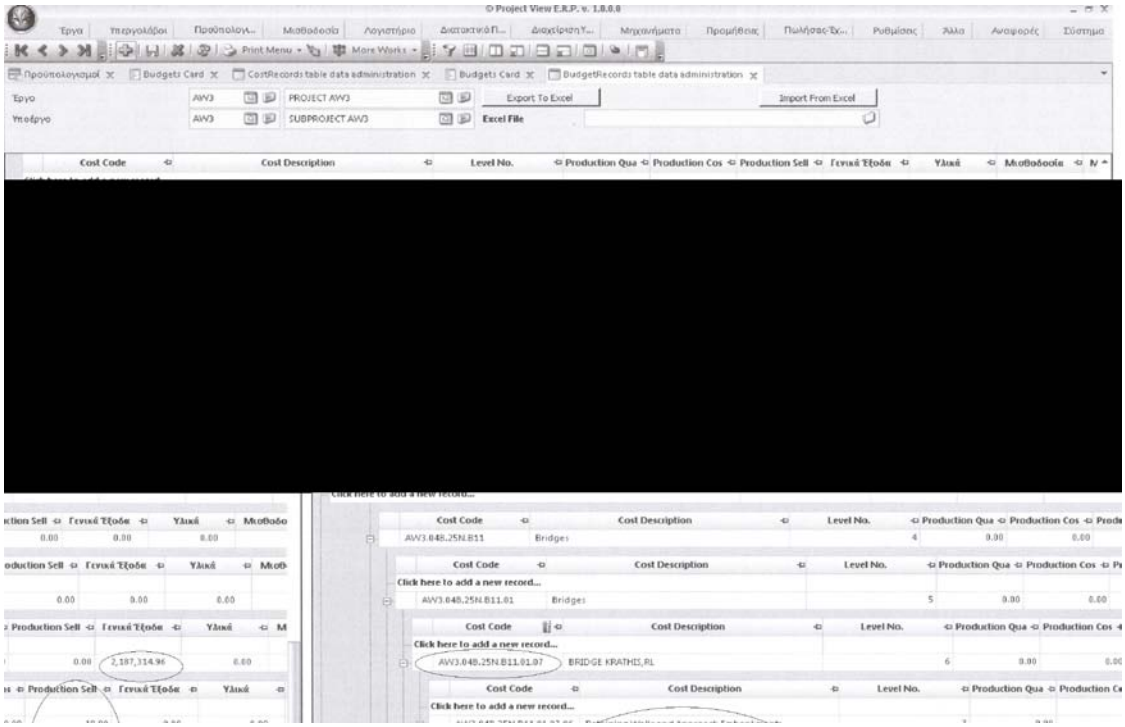


Figure 2: Budgeting WBS environment -Bridge Construction Budgeting Process

Following the procedure of integration of both budgeting and control stage, the actual cost database must be fill in throughout the project construction period as showing in Figure 3. In this database is clearly defined the identical WBS taken from budgeting procedure but filled in with actual cost information derived from the construction site. This actual cost is distributed in the five basic cost categories such as personnel, plant, materials, subcontractors and general expenses. All cost information is imported to the database by using simple excel files from project diary without the risk of operators' errors. Therefore the actual cost database provides a clear picture of the cost occurred in any level of the project.

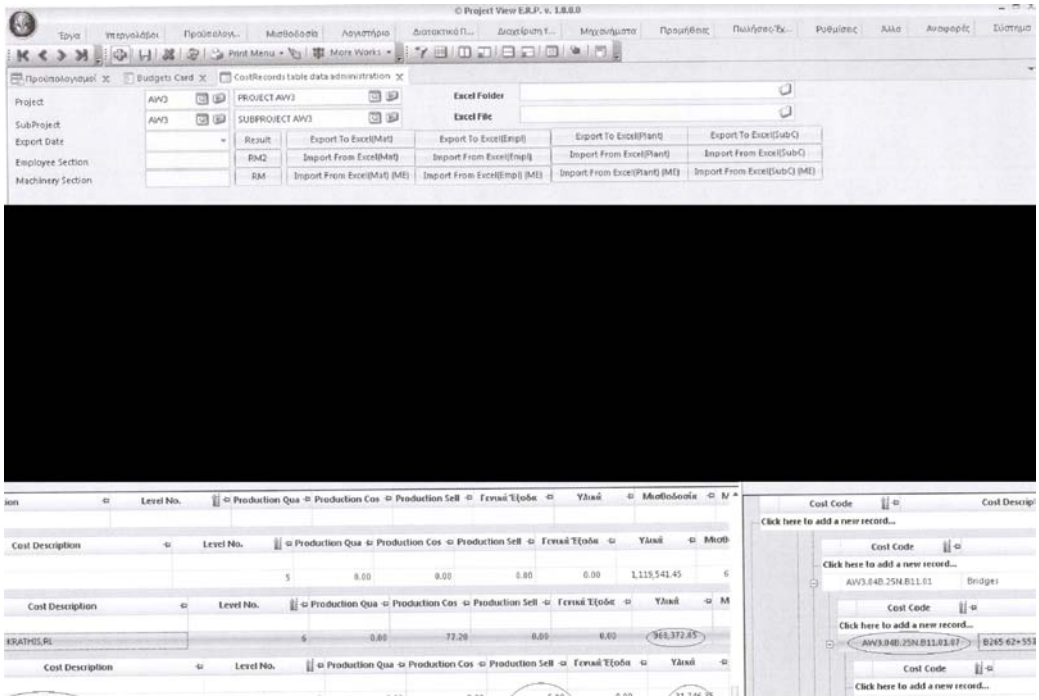
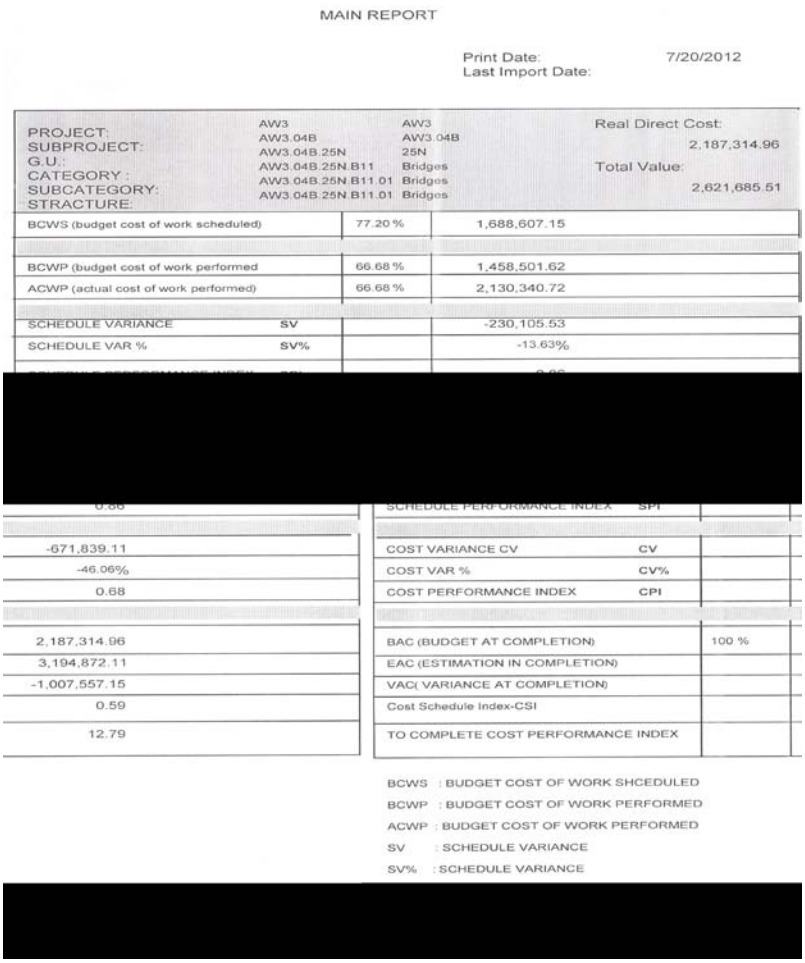


Figure 3: Actual Cost WBS environment-Bridge Construction Control Process

Since actual cost information is being imported to the system, the applied model is able now to calculate valuable reports supporting any decision making or actions to put project back on track.

IS application model data information is used to provide simple and reliable reports through a second analysis which has been described as Earned Value Analysis (EVA). EVA is a project control technique which integrates cost, schedule and technical performance. It proves the earn value of a completed work and compares it with actual cost and planned cost to determine the project performance and forecast its future trends. (Khamidi 2011). EVA provides consistent, numerical indicators with which projects can be evaluated and compared (Theodorakopoulos 2009). The EV analysis is an integrated remote monitoring technique for complex interaction of the time and cost parameters to provide the performance measurements of a whole project. It is an effective and useful tool assured that follows the integration analysis of budgeting and actual cost described previously.
Figures 4 & 5 are reports which extracted from the prototype integrated cost model, giving information. A real bridge construction has been chosen as an example to prepare these reports. Figure 4 presents all information regarding a bridge construction in process. By using the basic three variables, Budget Cost of Work Scheduled (BCWS), Budget Cost of Work Performed (BCWP) and Actual Cost of Work Performed (ACWP) it calculates the Schedule Variance (SV) and the Cost Variance (CV) and schedule and cost indices of this specific structure. EV analysis which is presenting in current report, showing itself as an objective and valuable tool to accurately compute cost Estimate At Completion (EAC) is the conventional Earned Value Management methodology with associated Cost Performance Index (CPI) and Schedule Performance Index (SPI). (Narbaev & Marco 2011)



MAIN REPORT

Print Date: 7/20/2012
Last Import Date:

PROJECT:	AW3	AW3	Real Direct Cost:
SUBPROJECT:	AW3.04B	AW3.04B	2,187,314.96
G.U.:	AW3.04B.25N	25N	
CATEGORY :	AW3.04B.25N.B11	Bridges	Total Value:
SUBCATEGORY:	AW3.04B.25N.B11.01	Bridges	2,621,685.51
STRACTURE:	AW3.04B.25N.B11.01	Bridges	

BCWS (budget cost of work scheduled)		77.20 %	1,688,607.15
BCWP (budget cost of work performed		66.68 %	1,458,501.62
ACWP (actual cost of work performed)		66.68 %	2,130,340.72
SCHEDULE VARIANCE	SV		-230,105.53
SCHEDULE VAR %	SV%		-13.63%

[redacted]

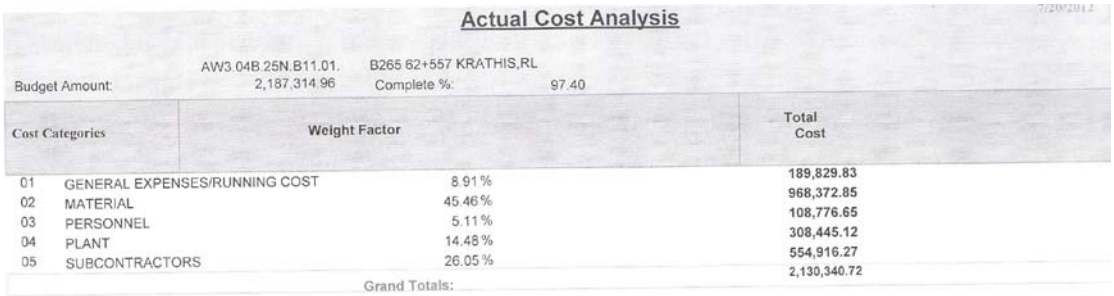
0.88	SCHEDULE PERFORMANCE INDEX	SPI	
-671,839.11	COST VARIANCE CV	CV	
-46.06%	COST VAR %	CV%	
0.68	COST PERFORMANCE INDEX	CPI	
2,187,314.96	BAC (BUDGET AT COMPLETION)		100 %
3,194,872.11	EAC (ESTIMATION IN COMPLETION)		
-1,007,557.15	VAC(VARIANCE AT COMPLETION)		
0.59	Cost Schedule Index-CSI		
12.79	TO COMPLETE COST PERFORMANCE INDEX		

BCWS : BUDGET COST OF WORK SHCEDULED
BCWP : BUDGET COST OF WORK PERFORMED
ACWP : BUDGET COST OF WORK PERFORMED
SV : SCHEDULE VARIANCE
SV% : SCHEDULE VARIANCE

[redacted]

Figure 4: Earned Value Main Report-SV, CV and EAC Calculations-CPI and SPI indices

Figure 5 is the sum report of analytical basic costing categories' reports which provides split information for the five basic cost categories. This tool is very helpful for project managers to control specific categories of cost, like concrete, subcontractors etc and proceed to corrective actions during the construction period



Actual Cost Analysis

Budget Amount: AW3.04B.25N.B11.01. 2,187,314.96 B265 62+557 KRATHIS,RL Complete %: 97.40

Cost Categories		Weight Factor	Total Cost
01	GENERAL EXPENSES/RUNNING COST	8.91 %	189,829.83
02	MATERIAL	45.46 %	968,372.85
03	PERSONNEL	5.11 %	108,776.65
04	PLANT	14.48 %	308,445.12
05	SUBCONTRACTORS	26.05 %	554,916.27
	Grand Totals:		2,130,340.72

Figure 6: Sum-Report: Five Basic Cost Categories-Actual Cost

CONCLUSIONS

This study is the implementation stage of a complete integrated cost management system development in a project delivery. A successful alpha version of an applied cost management model has been developed. Integration process between planning and control stages, through the IS model, is a helpful tool to derive valuable reports to the project managers and directors during the construction period, hence correction decisions may put the project back on track. The model will be tested in more

ongoing various projects and the results will be compared and used to prepare the final version of the integrated cost management system. The application model aims to maximize the performance of the proposed integrated system and used also as a feedback for further corrections. The integration process will be expanded in more components and more project factors by keeping WBS as a dominant factor of transferring information from planning process to control process.

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BUDGETING FOR MAINTENANCE OF UNIVERSITY BUILDINGS: CASES FROM JOHANNESBURG

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ABSTRACT

Maintenance of buildings is dependent on budgetary fund allocations. Past studies have revealed that budgeting for maintenance of buildings relies heavily on historical data, is not guided by sound policies or strategies or adequate foresight. For university campuses with varieties of buildings, this may imply consequential chronic dysfunctions, public health hazard, negative impact on brand development and higher operational costs. Despite the underlying importance, few studies have been undertaken in South Africa to gain deeper understanding on this issue. Using an exploratory case approach, a study was designed focussing on processes, policies and dynamics in budget development for maintenance of university buildings. The study investigated two universities in Johannesburg. A combination of documentary review and in-depth interviews was used to gather findings which were then thematically analysed. Documents used were mainly archival from the universities in focus. Six in-depth interviews were conducted. The study revealed that lack of proper policy framework to guide maintenance budgeting greatly hampered the effectiveness of the generated budgets. In addition cross-departmental rivalries and tussles often prevented synergies in the development of budget for maintenance purposes. A number of minimal measures were suggested to improve functionality and effectiveness of budgeting for maintenance of university buildings.

Keywords: budgeting, effectiveness, Johannesburg, maintenance, university buildings.

INTRODUCTION

Universities are characterized by their open access to a significantly large number of people, enormous social and historical significance, public funding, and facilities which require incessant maintenance. The need for continuous maintenance for university facilities is related to prevalent heavy usage and the historical nature of the buildings. Consequentially, heavy funding often from public coffers is committed to ensure the required maintenance is undertaken. This underscores the importance of budgeting for maintenance of university buildings. It is noted that more often than not, the budgeting for maintenance of building facilities is characterised by over-reliance on historical budgets, improper policy and procedure implementation and

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inaccurate maintenance information (Yik *et al.*, 2010; UNCHS, 1993). University facility managers encounter similar challenges when budgeting for maintenance. This paper undertakes a diagnostic analysis of budgeting process for maintenance of university buildings for two cases in Johannesburg. Consequentially the existing associated practices are analysed and recommendations made to improve budgeting process for maintenance of university buildings.

BUDGETING FOR MAINTENANCE OF UNIVERSITY BUILDINGS

The importance of periodical budgeting for maintenance of facilities cannot be ignored (Kelly, 2006 and Manganye *et. al.*, 2008). In particular, budgeting for maintenance of facilities is instrumental in efforts to attain desired functional efficiencies. Additionally, maintenance budgets are indicators of financial preparedness of facility owners or operators to invest in continued functionality of buildings. It is advised that budgeting for maintenance be informed and guided by sound maintenance strategies and policies to ensure greater effectiveness. However, this does not seem to be the case as reported by Westerkamp (1997) and later Boshoff (2009). Generally, Boshoff (2009) observes that budgeting for public asset maintenance in South Africa relies on an annual earmark of 10% of the operating budget for maintenance and takes historical perspective. It is argued that this method may be flawed as maintenance funding requirements are a function of the assets' needs and not total operating activity of an entity.

Despite the attached importance, maintenance of buildings in Universities is often poorly prioritized and misunderstood. Sherwin (2000) and Tsang (2002) report that built asset maintenance is perceived most Universities as a cost burden. This is perhaps related to the fact that in most cases demand for maintenance action, identified via an assessment of the condition of the building invariably exceeds the funds available (Pitt, 1997; Shen, 1997). Consequentially, Universities will always be reluctant to commit funds for asset maintenance (Chew *et. al*., 2004). This may be related to the fact that maintenance may be viewed as rivalling the core business function of the Universities. The linkage between maintenance expenditure and output production is often ignored. Maintenance budgeting then becomes an exercise based on last year's costs plus an allowance for inflation (Boshoff, 2009). Wireman (2004) reports that asset value based benchmarks forms the basis for best practice when preparing a maintenance budget. This is however disregarded in most cases (Kelly, 2006). This may be related to the fact that the senior management cadres rarely appreciate the link between facilities maintenance and profitability. It is therefore no wonder that Walker (2005) supports the need for Senior Management Staff at Universities to recognise facilities maintenance as a key business driver, and hence profitability in the institutions. This makes optimal maintenance of building facilities an operational prerequisite for Universities. Optimal maintenance is dependent on the efficiency of the maintenance budget (Grigg *et. al*, 2001). To achieve optimal maintenance, budgeting for maintenance must be periodical and should take into account the expected maintenance workload (Kelly, 2006: 42). For Universities, maintenance budgets must reflect the strategy of the maintenance function, define results to be achieved, plan the most economical use of resources, measure the magnitude and cause of variations and provide a plan of action and a basis for future policy (Wilson, 2002).

Yik *et al.* (2010) highlight various types of maintenance budgets. Of these, flexible, historical and zero-based budgets could be considered most appropriate for maintenance strategies used in University buildings. This is guided by considerations such as (1) the fact that flexible budget converts the University's maintenance strategies into operating plans (Khan *et al.*, 2007); (2) the need to consider historical performance data in building maintenance budgets for University buildings and as a way to improve operations (Zuzelo, 2010) and (3) using maintenance strategies to builds up a maintenance budget from scratch as advocated in *zero-based budget* formulation (Kelly, 2006). Each type of budget has practical distinguishable advantages and disadvantages.

The choice of budgeting framework for maintenance of university buildings must consider the three main issues. First, University buildings are largely aged and nearing physical and functional obsolescence; the accompanying decay can be controlled with sound maintenance (Flores-Colen *et al*., 2010). Second, the need for holistic evaluation of sustainability and costs issues when planning maintenance of each University building for (Gauzin-Müller and Favet, 2002). Lastly, formulation of a full works programme for each building and components detailing type of maintenance and maintenance strategy (Queensland Department of Public Works, 2010). The type of maintenance or maintenance strategy will therefore be chosen on the basis of maximizing the buildings functionality. However, it must not be forgotten that building maintenance planning must be accompanied by adequate funding (Flores-Colen *et al*., 2010). Technical and statutory factors need to be considered during the process of formulating the maintenance budget for University buildings (Wilson, 2002). Cognisance should be made of the fact that these factors differ across various stages of buildings life cycle. This is further complicated by the fact that university buildings are used for various purposes, are distributed across a wide age and are exposed to heavy usage. In line with a suggestion by Shim and Siegel (2008) the budgeting process must also take into account the short-term, intermediate-term and long-term goals of the University. Three essential elements for formulating the University buildings' maintenance policy exist. These are the choice of maintenance strategy, defining maintenance standard and allocation of maintenance resources. Building maintenance policy forms a critical aspect of university operations processes as it provides a management framework to determine appropriate maintenance strategy and standard (Lee and Scott, 2008). Maintenance strategy could be shaped by the need to adopt corrective, preventive or condition-based maintenance. El-Haram and Horner (2002) observe that adoption of standard for maintenance is dependent upon organisational resource level. This succinctly underlines the importance of maintenance budgeting process. Factors affecting maintenance budgeting process may be historical, endogenous, exogenous and economic according to Yik *et al.* (2010) or related to political influence, procurement, design and construction and maintenance and maintenance budgeting practices as outlined by Boshoff (2009:4).

An efficient maintenance budget is a natural performance assurance indicator. However, the budget preparation process is fraught with several challenges often related to difficulties in prediction of building performance and prioritisation of maintenance needs. For example, reliance on historical data may be limiting due to inability to successfully forecast maintenance expenditures (Langevine *et al*., 2002). Also, the development of effective maintenance budget for University buildings is

influenced by financial priorities set by the public patrons who fund academic activities (El-Haram and Horner, 1995). Additionally, the UN Centre for Human Settlements (1993) reports that inferior knowledge on actual cost of operations and maintenance for University buildings presents a great challenge. This betrays conflict in funds allocation often encouraged by the fact that budget preparation is often the task of finance departments that have little understanding of facilities operations and performance details. Furthermore it is difficult to separate operating costs from those dedicated to maintenance since they are often charged to one general budget of running costs. All these challenges suggest that maintenance budgeting process is bedevilled with uncertainties in decision making and inadequacies in regulations and standards. In South Africa, this is complicated by the fact that most funds allocated to institutions are used on staff salaries and that the unit value of funding and subsidies to universities from the public has been consistently reducing over the years (Buys and Nkado, 2006). Buys and Nkado (2006) emphasise the need for increased pro-active, rather than preventative maintenance management at these particular institutions as means of enhancing cost effectiveness. As part of this, it is also advised that the maintenance budget should be based on financial and maintenance requirements as set out in the maintenance plan that is informed by maintenance policies and strategies (Buys and Nkado, 2006). This forms the basis for pre-supposition explored in this paper that: '*Budgeting for maintenance of university buildings in Johannesburg is not guided by clear policies and strategies; consequentially, the process is hampered by poor decision making*'.

METHODOLOGICAL ISSUES

The study used a case based qualitative approach due to its "subjective" nature (Naoum, 1998: 38). Four universities existing in Johannesburg were contacted to participate in the study. However, two universities accepted to participate in the study. The study used a mixture of in-depth interviews and documentary reviews to gather information. In-depth interviews ensured that the respondents' professional experience, thoughts and opinions were well articulated. A total of seven respondents were interviewed from the participating two universities in Johannesburg. This population included facilities managers, supervisors, a financial manager and a director of operation. The criteria to select the respondents were based on the experience in facilities management, service duration, educational background and finance management. Documentary reviews were used to obtain information on best practices, organisational policy, regulations, planning and structure. The use of documents in institutional depository for research ensured some measure of authenticity. Bias, confirmability and authenticity in interpreting the professionals' opinions were addressed by the participation of three interviewers in all interview sessions. Emanating findings were analysed according to themes emanating from responses and documentary review. With regards to ethics, care was taken to adhere to the policies of the Universities studied, attainment of utmost confidentiality and non-disclosure of information uncovered during research.

FINDINGS AND DISCUSSIONS

The studied Universities each had diverse types of buildings ranging from: old and new buildings, difference in ages, sizes and uses. The following sections present summarized discussion of study findings. The discussion refers to the respective universities studied as A and B.

Management Structure

The management structures for both Universities were found to be hierarchical. Decision making for maintenance and maintenance budgeting was left to the divisional heads who could vertically delegate authority. This slowed down facilities operation as it took longer to make crucial decisions. This is further complicated by the fact that though maintenance budgeting was the preserve of finance department; it relied on information and plans from the facilities department. In such a set up, it would be logical to encourage greater horizontal rather than vertical communication across organisational structures (Daft, 2007). At University A, this was further worsened by the fact that the responsible departments for maintenance budgeting were involved in a turf wars as a result of lack of clarity in departmental roles. Thus maintenance budgeting at University A was fraught with poor information flow and communication. In comparison, information flow and communication at University B was considered more effective due to clearly articulated decision making structure and properly demarcated departmental roles.

Budgeting Methods

The study revealed that both universities used a combination of budgeting methods. The process of budgeting for maintenance of buildings was discovered to be highly flexible in terms of methods used. Whereas this is certainly desirable, it exposed the fact that budgetary control structures were lacking and as such decisions were largely ad-hoc and depended on the senior management at the finance departments. Furthermore, it also meant that budgetary needs were not benchmarked to asset value as recommended by Wireman (2004). In a hierarchical structure this could be open to abuse or bias by responsible individuals who had massive centralised powers and decision making responsibilities. This is worsened by the fact that both universities betrayed apparent lack of clear policies guiding maintenance and related budgeting. This subsequently works against optimal maintenance budgets alluded to earlier on by Grigg *et. al* (2001).

Maintenance Budgeting Guidelines, Processes and Procedures

Examination of the budgetary processes for maintenance at both universities failed to demonstrate any best practice. Processes were largely random and non-uniform. This could be related to the fact that processes are not well documented. However, the respondents all agreed that budgets for maintenance were generally submitted by maintenance or facilities departments to the Finance department in both Universities. It was also noted that lack of guidelines for maintenance budget preparation and unclear maintenance policies distorted the processes of development of budgets for maintenance. Finance department in University A however had some measure of guidelines on budgeting; however this had limited impact due to failure to specifically address maintenance issues or facilities context. University B did not follow any particular guidelines in budgeting for maintenance. Thus budgeting process was inclusive of all other institutional requirements. This automatically made maintenance of facilities vulnerable as immediate and highly visible needs such as staff salaries and direct learning requirements would be naturally preferred as alluded to by (Buys and Nkado, 2006). It is however laudable that limited positive measures were evident at both universities. For example, maintenance budget reviews were a norm at University A whereas maintenance performance evaluation existed at University B. These measures were not effective due to lack of supportive structures and culture.

Maintenance Strategies and Policies

Interview sessions revealed that both universities did not have clear maintenance policies but were guided by general policies on financial expenditure from the Finance department. Specifically, respondents at University A were categorical that no maintenance policies existed whereas respondents from University B were vaguely aware but unsure of any policies in this area. This is contrary to requirements for optimal performance of facilities alluded to by Lee and Scott (2008) and Wilson, 2002). Consequently, maintenance practices were haphazard, random and not indicative of desired optimal performance. It was however noted that both universities were guided by existing vision and mission in discharging maintenance of facilities. None the less, the vision and mission of the facilities department at University A was unspecific to the department and lacked clarity. However, University B's vision and mission of the facilities department was well documented, specific to the department and detailed. There are few and specific targets set for the maintenance budget which ignores the maintenance strategy. In addition, University B had pre-set annual targets for facilities maintenance; however, these were not based on maintenance objectives but on available funds. Once again this demonstrated that lack of adherence to best practices such as the need to base maintenance budgets on financial, maintenance requirements, maintenance policies and strategies as intimated by Buys and Nkado (2006), Yik *et al.* (2010) and Boshoff (2009). None withstanding this, University B's common targets complimented the institutional objectives, vision and mission statement. Also noted was the fact that both Universities relied on historical cost data to budget for their maintenance. This was then loaded with inflationary components without taking into account the evaluation of facilities maintenance need. This confirmed observation by Boshoff (2009) on banal and shallow use of historical data in budgeting for maintenance of facilities.

CONCLUSIONS

The focal issue emerging from the study was that budgeting for maintenance buildings at the two Universities was not well guided by any maintenance policies. This clouded the decision making process during budgeting with a lot of uncertainty thus making the process random and unreliable. Previous presupposition that *lack of maintenance policies results in poor decision making for maintenance budgeting for University buildings* was confirmed by the findings. In addition, the hierarchical management structure also made maintenance budgeting process highly susceptible to confusions and reduced effectiveness resulting from inadequate flow of information and inefficient communication.

RECOMMENDATIONS

Consequently, it is recommended that facilities managers ensure that proper guidelines are in place on budgeting for maintenance. Once formulated, the facilities' professionals should be duly educated on the policies and the policy implementation processes. Regarding the management structure and associated poor information flow, formation of a new maintenance budgeting framework is recommended (see Figure 1). The framework adopts a multi-professional management structure and reduces bureaucracy by ensuring that all respective stakeholders at the university are represented in an iterative maintenance budgeting process. This will ultimately ensure increased team and goal oriented efforts, heightened transparency, effective communication and shared responsibilities. The framework is envisioned as a complement to formulation of well-articulated maintenance and budgeting policies.

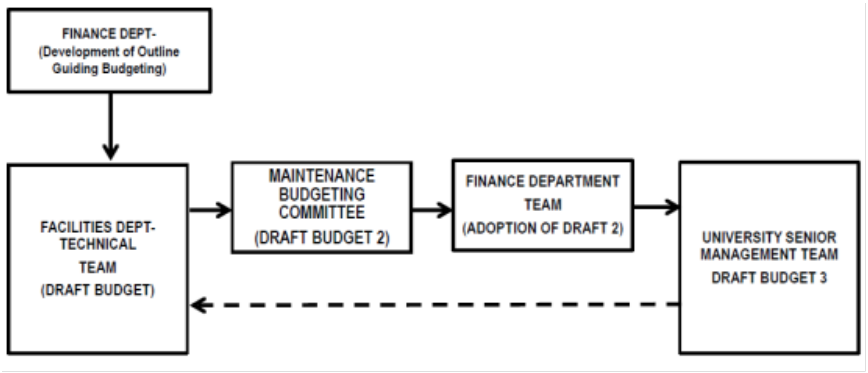

Figure 1: Recommended Framework- Budgeting for Maintenance of University Buildings

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DESIGNING FOR SECOND GENERATION VALUE – FUTURE PROOFING CONSTRUCTIONS

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ABSTRACT

Lifecycle consideration in terms of environmental impact and total cost of buildings attract increased focus in construction. Here, total cost and environmental impact both involves: erection, operation, maintenance, demolition, and disposal of the building. The mindset of Lean Construction is focusing on eliminating waste and adding costumer value to both the design and build phases. But in this aspect waste and value is only viewed in the first generation owner perspective with fixed usage. Through theoretical considerations this research looks into the change of costumer value. Changes happen, so do changes in usage of buildings. Organisations and structures change, the result is often changed requirements or changed value perceptions. Costumer value is decreased since the owner has a building not fitting the present demands. Hence, there is a need of a construction redesign or in a worst case scenario the building end up unused. If, in the design process thoughts have been put into the *"value-lifecycle"* including second and even third generation usage, the transformability process of needs from generation to generation could be improved. This way value is kept in the building. Keywords in what could be called Flexible-Value-Design are multiple usage possibilities, flexibility and transformability.

Keywords: Flexibility, Lean Construction, Transformability, Value, Waste.

VALUE CREATION IN CONSTRUCTION

Value is an important element in Lean Construction and design. Here, the basic concept is to remove waste in order to increase the value creation (Freire and Alarcón 2002; Koskela 1996; Koskela 1992). According to the Lean philosophy value is to build what the customer wants or desires. Thus, it is a fulfillment of the customers' whishes, demands, and requirements. Johnson & Kaplan (1987) defined value this way: *"value of any commodity, service, or condition, utilized in production, passed over into the object or product for which the original item was expended and attaches to the result, giving it its value."*

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The question which needs to be asked is: who is then the customer? In Lean an activity is said to have two different customers (Wandahl 2004). Construction projects consist of multiple trades with interacting and interdependent activities (Bertelsen 2003; Salem *et al.* 2006). The first customer is the trade which have to follow up on the completed activity, i.e. the next link in the supply chain. The successor is dependent on the quality of the work and it being ready on time. If the previous activity is not completed or rework is necessary his own work cannot be conducted timely. If he has no buffered activities his productivity will decrease. Furthermore, because the construction is restricted by a tight sequence delays in one activity will easily be transmitted and therefore affect other subsequent activities (Lindhard and Wandahl 2012). The second customer is the end customer, user or the owner of the construction. Here, functionality, design, quality, cost, time, etc. are affecting the end customers' perception of value at the acquisition date.

Value creation is said to be a fulfilment of the customer's needs (Freire and Alarcón 2002). The Lean Construction philosophy seeks increased customer value. But value is only viewed in relation to the 1st generation owner and with fixed usage. Thus, focus is only on capturing and fulfilling the present needs of the owner (Freire and Alarcón 2002). Therefore, only the current needs are in the design process captured and transferred into design specifications (Ballard and Koskela 1998). The owner's present needs represent only a snapshot of the owner's value perception which over a period of time will change (Flint *et al.* 1997). Usage of buildings follows the changing needs of the owner and users and does therefore also changes with time. Therefore, the perception of the buildings value decreases when the building no longer fulfils the owner's needs.

More attention and new approaches is needed in order to overcome the owners changing value perception and preserve the value of the building. Moreover, when designing buildings it must be taken into consideration that the building at some point will change users and even owner. Here, the building now has to fulfill the needs of the new users or the 2nd generation owner. Furthermore, when the building is put up for sale the transferability is important, and together with the market value it composes a large share of the owner's value perception of the building.

In order to preserve the value of the building the buildings fulfillment of need has to be flexible making it possible to adjust for future needs. Therefore, when designing and constructing with multiple usage possibilities in mind much more value can be added to the building. Furthermore, to future proof the construction, 2nd and 3rd generation owner value should also be considered to increase the buildings value in the whole lifecycle.

A CHANGING ENVIRONMENT

The world is not static but dynamic and changing. Companies and cities develop through time and causing the surrounding environment to change. The developing companies have continuously to make organizational, infrastructural, and constructional changes to adjust and fit into the new reality (Simons 1994). Still constructions are when designed and constructed viewed as static monuments.

The companies changing constructional needs lead to redesigned, sold, or in worst case unused or demolished constructions. Thus, sold constructions do reflect the tendency of changes in the owners' value perception and needs. Historical evidence

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show that the usage of constructions change. Therefore, in an attempt to picture the changes in usage of construction the national statistic of registered sales in Denmark is shown in Table 1. The figures have to be related to the number of inhabitants. Denmark is a small country with approximately 5.4 million residents.

Table 1 Registered Sales in Denmark (DST 2012)

Sales: Year	**2006**	**2007**	**2008**	**2009**	**2010**
Factories and warehouse buildings	1.756	1.617	1.219	705	1.240
Agricultural property	5.498	5.598	4.782	3.556	3.595
Business property	2.069	2.061	1.545	1.006	1.289
Mixed residential and business property	3.448	3.122	2.306	1.538	1.799
Apartment block	3.765	3.526	2.476	1.738	2.333
Single-family homes	58.950	58.270	46.138	40.551	46.504
Owner-occupied flats	22.098	20.834	15.567	13.540	15.943
Holiday homes	11.412	9.858	7.522	7.000	8.020

From Table 1 the total business related sales can be calculated. This includes factories and warehouse buildings, agricultural property, business property, and mixed residential and business property. From 2006 to 2009 the total business related sales varied from 6.805 to 12.771 sales. During the financial crisis the sales dropped down.

Despite a concomitant changing effect which was expected to race sales the crises did moreover affect the companies' solidity and the propensity to invest. Furthermore, the crisis did make it difficult to receive mortgage loan. This made the property difficult to sell and the prices dropped (Brunnermeier 2008). Therefore, a lot of companies' have been forced to keep constructional facilities which do not fit the current needs. To keep the construction still useful transformability and flexibility has been extremely important.

Not only big financial crises affect the owners' constructional needs. Small changes or developments in the surrounding world continuously change the owner's value perception. Changes happen both inside and outside the company and forces changes to the constructional needs. Everything can change and affect the usage of the construction. Thus, changes are influenced by an infinite number of parameters which make the changes complex and impossible to forecast.

Changes in the organization will always induce changes in usage of the constructional facilities. The owner can chose to ignore these changes by accepting a reduced fulfillment of needs, he can chose to redesign the construction to fit current needs or he can chose to sell the constructions where after the 2nd generation owner has to redesign the construction to fulfill his needs. To fit the building to the new demands the building has to go through a transformation process.

Transformability is important. Multiple options promote the likelihood of a redesign of the constructions. If the construction is not transformable it is a risk that it

sometimes in its lifecycle will end up unused or demolished before necessary. The key is to design the building so the transformation has to be as little and as simple as possible. Thus should changes be as quick, easy, and cheep to complete as possible. To promote transformability the building needs to be designed for a changing environment. Thus, the design process should consider the whole *"value-lifecycle"* of the construction which has to fulfil the changing needs of both 1st 2nd and 3rd generation owners. The question which needs to be answered is:

How do we handle the changing needs of the customers and how can we increase the constructional transformability to make the constructions fit to current needs?

The research is explorative, open-minded, and visionary; it tries through creativity to avoid the limitations of a narrow-minded and traditional way of thinking. The reseach presented is grounded on theoretical considerations alone but will be followed and supported by further research. The future research will focus on the changing constructional needs of companies in Denmark.

HANDLING CHANGES IN USAGE

Companies are continuously affected by their surrounded environment which changes their needs and value perceptions. Often these changes are related in the marked and therefore difficult to forecast. The outcome is changed usage of the company's constructional facilities. It is important to secure that the building is fully utilized and still fulfil the company's needs. Therefore, to enable the company to respond to changes, constructions need to be adaptable.

Even though changes in general are difficult to forecast some changes might be predicted and should be considered already in the constructions design face. Many future problems can be caught before emerging by carefully contemplate the construction design. Tendencies in the surrounding environment and the existing marked can be analysed and predicted just as in real business life.

Foresight is important. Here, the company's plans and expectations to the future are in particular important. For instance, it would be stupid to build a construction with a non-expandable max capacity if the company is experiencing or expecting high growth. One way to capture the future needs could be by making the owner conduct a *"lifecycle"* plan of his expectations to the future usage of the building in its lifetime. Thus, the design face should proceed based on the owner's *"lifecycle"* plan. Predicting the future is difficult. Therefore, it is important to notice that the *"lifecycle"* plan is only expectations which thus are not necessarily fulfilled.

In order to optimize the value-fulfilment the *"lifecycle"* plan needs to cover all relevant focus areas. One example to a focus area to carefully consider is the location. A lot of factors have to be taken into consideration. For instance: Does the location fulfil potential future needs? Does the location make it possible to upgrade and expand the facilities? If a future expansion is considered should surrounding acreage be purchase? How do geographical changes in the marked and organizational changes in the company affect the location? How is the location in relation to transport options and logistics and can the location fulfill potential future needs with increased sales? Is it possible to attract a qualified labour force? If a future sale is necessary would the location promote a future sale? All relevant questions need to be answered and considered already when the construction is designed.

There are a lot of other relevant focus areas besides the location. Another example could for instance be environmental concerns including future environmental requirements, energy consumption, and the company's external appearance as an environmentally preferable company. It is important to state that the list is not considered exhausting. The number of questions and consideration continue almost infinitely. If all concerns have to be considered the design process will become very complex and cost full. Therefore, the purpose with the *"lifecycle"* plan is to let the company identify the relevant key issues. These key issues do then form the groundwork to the subsequent design of the construction.

Furthermore, since plans does not always become reality the contemplate design with relation to the owners *"lifecycle"* plan should be supplemented with an increased flexibility and transformability in the construction design.

Flexibility is understood as the ability to change the constructional usage without needing to make constructional changes. Thus, increased flexibility makes the construction agile because the ability to adapt to the changing environment is increased. The key to flexibility is design the construction with multiple applications in mind. This could for instance be by making the inner shape of the room flexible. This could be achieved by using walls or interior which are easy to displace.

Constructional flexibility would make it less cost full to change the design since it reduces the need of transformation in the adaption process. But instead will the creation of flexibility in the construction most likely induce increased cost to the erection of the construction. Therefore, both related expenses in cost and time and possible savings have to be taking into consideration in the design face. Therefore, every initiative, which purpose is to increase the flexibility of the construction, has to be considered individually with the owner as the decision-maker.

Transformability is the ability to change usage of the constructional facilities. Opposite flexibility the construction is transformed in the process. The constructions transformability is determined in relation to the cost, time, and the resources spend in the transformation process. Basically there are two different types of transformability. Here, one type of transformability is related to the ability to transform the existing structure in order to adapt to the changing environment.

One approach to achieve transformability in the existing structure could be by reducing the number of load-bearing wall which penetrate the inner structures. This increases the adaptability in the inner design of the construction where light wall easily can be broken down or dissembled.

The second type of transformability is related to the ability to ad structures to the existing structure. This form of transformability could for instance be related to the possibility to add an extra floor to an existing construction, building an expansion, or constructing an entire new structure. Since this transformation has to be completed without ruining the design of the constructions both design and structural concerns are critical. Since increasing the transformability of the constructional structures, likewise flexibility, is cost full a cost-benefit analysis needs to be preformed. Again the initiatives have to be considered individually where it in the end is the owner's call to make the final decision.

It is important to notice that the effects of value changes not are limited to be handled in design. Changed values and needs can have an impact already in the construction phase. Often the owner does, in collaboration with the architects, continuously make changes in the design. This is often small changes related to materials, textures, or colors but sometimes the changes are having a greater impact even at the structural design. Therefore, construction planning and scheduling does not only have to cope with the complexity and changing nature of a construction site it also has to be able to handle the owners changing needs satisfactorily. Changed design caused by changed owner values or needs bring uncertainty into the schedule. The scheduling tool needs to be able to handle this uncertainty and still keep a steady workflow to maintain high productivity.

Today most changes evolve unforeseen. Changes can happen at any time and therefore interrupts the making ready process. To minimize the impact changes has to be foreseen. One approach is to investigate the triggers which cause changes. This helps site-managers to understand and predict future changes. A second approach to foresee upcoming changes and react faster is to improve the communication between construction site and owner and architect. If structural changes are needed the flexibility and transformability of the construction is once again important to adjust the construction to fit current customer needs. Moreover, the flexibility and adaptability is important in the workforce and in construction process itself. Communication and collaboration are essential when handling changes. It takes teamwork to work around the changes to find and exploit new possibility and to optimize the process. Furthermore, communication and collaboration does minimize misunderstandings.

FUTURE RESEACH

This research is an initial part of an on-going research that emphasises Lean Construction and creation of customer value. The main focus is on how to coop with changes in the customer's value perception in relation to usage of the constructional facilities in the constructions lifetime. The purpose of this research is to create a broader understanding of values not as static but dynamic. Additional further research is needed to support the research and to form guidelines for achieving flexibility and transformability in the design face.

Future research areas include:

- What are the root causes to why companies replace or redesign the constructional facilities.
- Understanding the dynamics which drives and triggers changes.
- How constructions are adapted to the changing environment and which parameters do increase this transformability.
- How flexibility and transformability can be achieved in an constructions
- What are the key parameters which should be considered in order to future proof a construction.
- How and when foresight is achieved.
- Improving the schedule in handling unexpected changes

CONCLUSION

In relation to the Lean Construction philosophy value is achieved by fulfilling customer needs. To respond on a changing environment constructional usage needs to adapt to respond to the changing world and fit to the present needs. Even so constructional value is in design considered as static. Thus, the design process should consider the whole *"value-lifecycle"* of the construction which has to fulfil the changing needs of both 1st 2nd and 3rd generation owners.

In order to preserve the value in the construction the constructions fulfillment of needs have to be flexible making it possible to adjust for future needs. Changes are difficult to forecast but instead of ignoring the changes tendencies in the surrounding environment and the existing marked can be analysed and predicted. The company's plans and expectations to the future are in particular important. Therefore, it is suggested that the owner should conduct a *"lifecycle"* plan of his expectations to the future. Thus, the design face should proceed taking the owner's *"lifecycle"* plan into consideration.

Since forecast not always are reliable the construction still needs a flexible and transformable design to increase the adaptability to changes in usage. Flexibility is understood as the ability to change the constructional usage without needing to make constructional changes while transformability is understood as the ability to change usage of the constructional facilities by transforming the constructions. The constructions flexibility and transformability is determined in relation to the cost, time, and the resources spend in the adaption process.

Transformability can be categorized into the ability to transform the existing structure and the ability to ad structures to the existing structure. Since transformation has to be completed without ruining the design of the constructions both design and structural concerns are critical. Opposite is constructional flexibility achieved by designing the construction with multiple applications in mind.

Increasing constructional flexibility and transformability, to make the construction agile to changing usage, is cost full. Therefore, both related expenses in cost and time and possible savings have to be taking into consideration. Every initiative, which purpose is to increase the flexibility or transformability of the construction, has to be considered individually with the owner as the decision-maker.

The tendency of changes in customer needs is often already experienced during the construction phase where the schedule has to handle the unexpected changes in the design satisfactorily. If a change requires structural changes flexibility and transformability of the construction is once again important. The impact of changes can be reduced by understanding the triggers to predict future changes. Furthermore, the impact can be reduced by improved communication and collaboration at site.

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EFFECTIVENESS OF DUE PROCESS UNIT OF NIGERIA-CONSTRUCTION PROFESSIONALS' VIEW

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ABSTRACT

The Budget monitoring and price intelligence (Due Process) policy reform initiative by Nigerian government is to develop criteria for assessing contractors' competences in periodic prequalification juxtaposed with the criteria for assessing project prequalification based on current data about contractors' capacities. The criteria are financial strength, past experience and adequate resources for periodic prequalification based on classification and qualification levels.
An improved contractor selection process is achieved in the public sector as barriers to entry are removed and protection of public and client's interests accomplished. The population of study covers stakeholders who expressed opinion on its effectiveness. Field trips were made. Secondary data were obtained from various materials relevant to the subject matter. The data is presented in a simple descriptive format using frequency tables. The outcome of this research work revealed all stakeholders are unified in belief that it will achieve desired objectives and call for renewed commitment and dedication to an improved contract procurement system free of sharp practices.

Keywords: Approval thresholds, Corruption, Due diligence, Financial bid, Prequalification.

INTRODUCTION

The establishment of this unit by President Olusegun Obasanjo in 2001 was an indication of obvious lapses in the country's procurement system over the years and abuse to rules and standard in the award and execution of public contracts in Nigeria. The consequences of these are a procurement system characterised by inflation of contracts cost, over-invoicing, diversion of funds, abandonment of government projects, denial of social amenities to the citizenry, proliferation of uncompleted projects, less quality of work and so on. Furthermore, the yardstick for measuring the veracity and effectiveness of a due process are sacrificed as competition, competence, integrity, transparent and value for money are non-existent. However, the establishment of the due process has brought about a total re-awakening in the process of award and execution of contract, so much that certain level of credibility has been restored to the process. The different stakeholders acknowledged this fact but expressed divergent views on its effectiveness as the system is still fraught with corruption. As a result of the retrogressive outlook of the subsisting method, due process became an emerging trend necessary to alert Nigerians that

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corruption is no longer fashionable in the Project procurement Process. Previously, researchers like Donny M. Mangitung (2010) worked on Typical contractor prequalification characteristics of public procurement practices in Indonesia, Onukwube and Aladeloba (2011) examined Modelling the determinants of project development budget and the works of a host of other numerous researchers in their area of study were reviewed by the researcher, (but) it appears that little research has been done with regard to the effectiveness of Budget monitoring and price intelligence policy reform initiative geared towards project procurement in any government hence the need for this study. The aim of the study is to appraise the views of practitioners on the effectiveness of Due process as a way of encouraging the emergence of an enduring project procurement process. This will enhance the awareness level of professionals in Nigerian construction industry on the effectiveness of Due process thus encouraging the evolution of more enduring procurement system and serve as a useful perspective of professionals on the subject matter.

RESEARCH PROBLEM

According to Calvert et al [2003], Construction projects development involve a great number of people interacting to achieve set goals which is heavily dependent upon inflow and outflow of information. It is therefore imperative to adopt a medium of communication free of ambiguity and ambivalence which will leave no one in doubt as to what is being said. This no doubt encourages cross fertilisation of ideas; new thoughts, challenges and innovations necessary to improve and re-direct its operations. Therefore the research work will endeavour to answer questions bordering on what the due process is all about, who the participants are, how the due process operates; its requirements vis-a-vis what is expected of the participants while the following objectives are also considered: (1) to identify the factors inhibiting the operation of due process. (2) to determine the extent to which these factors affect the operation of due process and (3) to analyse the views of the practitioners with a view to determining the continued relevance of Due Process as a project procurement process. Entering the construction industry is relatively easier than entering the manufacturing industry, as illustrated by the number of construction companies being dominated by small and medium-sized companies. However, construction business failure is higher than in the other industry (Arditi etal. 2000; Kangari 1988). Thus, to protect public and client interests and reduce barriers to entry, complex mechanism is continuously being developed to avoid market failures or an individual contractor's failure in order to meet its contractual obligations (Mangitung 2005; Russell 1996; Schulman1982).

DEVELOPING PROCUREMENT STRATEGY

Obiegbu (2005) posited that procurement is the process that creates, manages and fulfils contracts; and as such forms an integral part of construction projects and occurs at any point in a project cycle whose external resources are required to provide supplies and services in any combination or in the disposal of surplus plants, equipment and materials and demolition of redundant building and infrastructure. Procurement starts immediately the need for it is identified and ends as soon as the transaction is completed. However, the strategy chosen is governed by certain parameters including available resources, nature of

job, risk sharing, Degree of complexity among others while the consideration of organizational methods including contractual arrangements, method of procurement, bidding procedure and conditions of contract remain very material.
The vehicle on which the objectives of the Budget monitoring and price intelligence (Due Process) unit are carried across remains its vision and mission stated as: to help move Nigeria to a level where public procurement is governed by principles of integrity, transparency, competence and competitiveness as national ethos and to use the due process mechanism to re-establish and sustain an open, transparent and competitive federal procurement system that is integrity driven, upholds spending within budgets and ensure speedy implementation of projects in other to achieve value for money outcomes without sacrificing quality and standards respectively. (BMPIU 2006)

These discussions have been tailored towards the six core requirements that the unit seeks compliance namely advertisement which allows for equal and effective communication to enable all participants in the contract market effective competition. Advert further spell out guidelines for both contracts below #10,000,000 and those above. Advert for the first categories of contract can be placed on the notice boards erected in conspicuous layout at the ministry, agency or department while the advert for the second categories must be placed in not less than two National Newspaper or Government Gazette. This is aimed at addressing the problem of transparency noticed in the old order which had led to the award of contract to ghost firms, sales of letters of awards; existence of proxies representing the interest of individuals and firms, certification of non-existing works for payments and so on; will encourage equal access to information by all prospective participants in the public contracting arrangements. There are specific standards expected to be observed in placing adverts and the details must include the project title, name of client, names of consultants, location of the project, general distribution of work, appropriate cost range, the form of contract, the likely date of commencement, anticipated completion date, tender documents to be issued, bond requirements and many more relevant information deemed necessary. The prospective contractors are also expected to respond by submitting a resume' of their company with the following basic information namely Name of company, location of head office, company's website, Email, Telephone ,fax of company, Names and addresses of the directors, types of ownership, class of registration with the federal ministry of works and company registration, organizational structure, Number of years in business, company's annual turnover, the list of current work loads, the list of completed projects including the titles of the works ,names of client, location of work and total contract sum. Others include the names of personnel; their qualification, experience, expertise, availability of operatives, available plants and equipments, types, condition and number, name of bankers and sources of funds.

CONTRACTOR PREQUALIFICATION: DEFINITIONS

Contractor prequalification is commonly found in the literature as a single definition, namely, a process of assessing contractors' competences required by regulations or by clients before a bidding stage using a set of main criteria in order to find responsible and eligible contractors that can perform the construction work completely and satisfactorily

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if awarded the construction contract. Prequalification is a screening process applied to contractors before tendering; to reduce the risk of project failure (McCabe et al. 2005)

Periodic prequalification is a process of developing a standing list of contractors relevant for a certain periodic time frame, some project types and a certain range of project sizes, which can be used by a client for short-listing or inviting bid. This type is usually separated from project prequalification in terms of time and purpose of evaluation. Standing list, select list and approved list are commonly classified as this prequalification type. Sometimes a client develops the tender list from these lists without further qualification. By contrast, project prequalification is a process to develop a list of qualified contractors for a particular project, on a project-by-project basis, which can be combined with periodic prequalification, for short-listing or inviting bid.

Prequalification Process and Criteria

Prequalification is a process by which clients evaluate the competence level of a prospective contractor to perform a given task or responsibility to satisfaction. This is the very first elimination stage of would-be consultant/contractor who responded to an invitation for prequalification advertisements. It is usually a process that precedes the issuance of drawings and proposal. In a bid to ensuring quality performance, prospective contractors are subjected to screening by the client or its representatives in accordance with established criteria regarded as necessary ingredients for ensuring quality performance. The level attained by the prospective contractor on a score scale of 100 percent would determine whether or not a participant qualifies. The analysis is based on set of objective criteria which are technical and financial in nature. The two main objectives aimed at achieving are:
-Short listing and selecting competent respondents to the adverts.
-weeding out those who do not pass the competent test of the commercial or financial bid.

The criteria adopted are also categorized into two namely those that are regarded as sacrosanct; that is a-must-get for all the companies and those that are not depending on the nature of registration of such company-an enterprise or limited liability company. All the must-get criteria score zero on the weighing scale and are regarded as responsive-absence of anyone could automatically disqualifies an applicant from the exercise. These are sets of documents which qualifies a prospective contractor for participation in the Pre qualification exercises. They are:
-Evidence of incorporation of Business name-0%
-Company registration with federal ministry of works in relevant category-0%
-Audited account of company for three years-0%
-An evidence of tax payment/clearance certificate for three years-0%
While the non must-get criteria are graduated as:
-Evidence of financial capability and banking support-15%
-Experience/technical qualification of key personnel-25%
-Evidence of similar projects and knowledge of the industry-20%
-Capacity of company in terms of equipments and technology-20%
-Annual turnover-5%

The remaining 10% is allotted to respondents with evidence of local contents and community social responsibility in support of the local content policy of the federal government. Best practice in contracting establishes the benchmark score for prequalification acceptable for considering a respondents as competent as 70% and above (BMPIU,2006)

The issuance of an invitation-to-bid documents to a prospective contractor who had partaken in the prequalification process pre-supposes that he is successful and thus a ***Competent Bidder***. The Bid documents contain sufficient information to enable competition take place under strict fairness. The tender document comprising technical and financial parts is expected to be submitted within six weeks of issuance of Bid documents. At the close of bidding, the tenders are opened in the presence of the bidders or their representatives and the civil society group in order to demonstrate openness and fairness in the procurement process. Having gone through the above, a competent Bidder adjudged as having been technically and financially qualified is produced and offers the client the lowest cost for execution of the contract. It therefore requires that a check list for review and certification approval of the different stages of the procurement process be produced.

RESEARCH METHOD

Considering that Due process is a reform initiative by Nigerian government to accentuate the emergence of positive changes in the people's standard of living and it is expected to be achieved by meeting the client's quality requirement on a construction project. According to Oakland (1999), Conformance (doing things right) with regard to former requirement set by producer is of great importance. Experience shows that this often caused significant gaps between the clients' need and expectations and the requirements that the producer was striving to meet.(Sorgvist 1998). Consequently, medium of communication must be easily understood to encourage participation. The method of collecting information was necessarily crafted in such a way that respondents are encouraged to divulge information-an initial step was to consult a group of construction practitioners to identify a set of concrete measures for Budget monitoring. An inventory of items of Budget monitoring and price intelligence measures was undertaken for the present study. These items were randomly ordered in the instrument to discourage potential response bias, to engage participants in arms-length discussion and in some cases, orally interviewed to elicit information. In the application of questionnaire, the respondents were requested to rate each of the prequalification criteria and the objectives of due process in form of a priority scaling table with 6 options; 5=very, very important, 4=very important,3=just important,2=less important,1= negligibe, 0=not important. In order to test the effectiveness of the survey instrument, a pilot survey involving 10 professionals was conducted for clarifying and refining the questionnaire. This helped to facilitate the identification of inherent defect in the structure and rendition of the questionnaire thus prompting a redraft of same and the interview schedule. The sample size 25 is considered to be representative enough and cuts across all the professionals in the built environment. 16 of the 25 questionnaire were retrieved; 64 percent of the total given out. Data collected were analyzed using simple descriptive frequency table. Limited sample size is used in this research; nevertheless, the researcher hopes to achieve

greater sample size in subsequent works which can then be subjected to mean item score, spearman ranking, correlation matrix, linear regression analysis, chi-square and factor analysis for more insightful inferences on the subject where appropriate.

RESULTS AND SUMMARY OF FINDINGS:

Professional Qualifications of Respondents

The response to this question is as depicted below:.

Table: 1

Non corporate	11	44
MNIA	6	24
MNSE	3	12
MNIOB	4	16
MNIQS	1	4
Total	25	100

Respondent's involvement with Government project

The response on the involvement of respondents with Government projects is as depicted below:

Table: 2

Response	**Nos.of respondents**	**Percentage**
Yes	16	64
No	9	36
Total	25	100

Factors inhibiting the operation of the due process:

The first objective of this study is to identify the factors inhibiting the operation of the due process.

Documents considered important before bidding for government project.

The results are as presented.

Table: 3

Serial Nos.	**Criteria**	**Number**	**Percentage**
1	Evidence of incorporation	14	32
2	Registration with federal ministry of works	9	21
3	Company audited account for 3 years	6	14
4	Evidence of tax payment for 3 years	5	11
5	All the above	10	22
	Total	44	100

Level of importance respondents attached to the selection criteria

The third objective of this study is to analyse the views of the practitioners in order to determine the continued relevance of due process in project procurement. The results are as presented below:

Table: 4

Serial Number	Opinion Expressed	Responses	Percentage
1	It is straight forward and sincere	8	50
2	It is cumbersome and fraught with Abuses	8	50
	Total	16	100

Extent to which these factors affect the operation of due process

The second objective of this study is to determine the extent to which these factors affect the operation of due process (level of importance). The results are as presented below:

Table: 5

Serial nos.	Criteria	Level of importance						Nos.of respondents	Percentage
		5	4	3	2	1	0		
1	Evidence of incorporation of Business name-0%	8	4	4	5	4	-	25	100
		32	16	16	20	16	-		100
2	Company registration with federal ministry of works in relevant category-0%	6	4	9	3	2	1	25	100
		24	16	36	12	8	4		100
3	Audited account of company for three years-0%	-	-	3	9	10	3	25	100
		-	-	12	36	40	12		100
4	An evidence of tax payment/clearance certificate for three years-0%	-	14	4	2	4	1	25	100
		-	56	16	8	16	4		100
5	Evidence of financial capability and banking support-15%	8	4	3	2	6	2	25	100
		32	16	12	8	24	8		100
6	Experience/technical qualification of key personnel-25%	-	-	-	18	4	3	25	100
		-	-	-	72	16	12		100
7	Evidence of similar projects and knowledge of the industry-20%	12	-	4	1	-	-	17	68
		48	32	16	4	-	-		100
8	Capacity of company in terms of equipments and technology-20%	-	9	-	2	3	1	15	60
		20	36	20	8	12	4		100
9	Annual turnover-5%	-	-	4	8	5	3	20	80
		10	10	16	32	20	12		100

CONCLUSIONS

This study sought to appraise the effectiveness of Budget monitoring and price intelligence unit of the Nigerian Government. This study has been able to establish that participants expressed divergent views on the operations of the Due process especially in areas of Documents considered to be necessary for bidding (must-get), its objectives and sincerity of the operatives. These objectives are carefully selected in order to encourage the evolution of a more enduring system that will not exclude a prospective contractor for flimsy reason. Based on this result, the following suggestions are offered to ensure improvements of the Due process: 1) contracting firm or companies should be encouraged to involve more registered members of professional bodies in their personnel team, 2) government should embarked on awareness campaign to encourage participation, 3) the prequalification criteria should be made public with available projects well advertised to create more awareness, 4) the due process should be made operational at all levels of governments in Nigeria rather than limit it to federal government projects and 5) any criteria that does not have direct linkage to the technical ability of the contractor should be dropped.

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ESTABLISHING RELATIONSHIP BETWEEN CHARACTERISTICS OF PREVENTIVE MAINTENANCE AND COST PERFORMANCE

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ABSTRACT

The building maintenance costs are rising rapidly from time to time due to poor maintenance in the past. In UK, total spending on building maintenance had a dramatically increase of 66% in the past 10 years. In Malaysia, the development plan allocation for repair and maintenance works in building sector increased from RM296 million during the Eighth Malaysian Plan to RM1,079 million during the Ninth Malaysian Plan. However, the development plan allocation for repair and maintenance works in the Tenth Malaysian Plan has decreased to RM500 million. The decrease of resource allocation for building maintenance activities urges the professions to develop solutions on reducing the maintenance costs. Thus, it is vital to identify the cost characteristics of preventive maintenance, includes scheduled maintenance and condition-based maintenance through literature review. The characteristics of preventive maintenance always affect the maintenance cost performance. Therefore, relationship between characteristics of preventive maintenance and maintenance cost performance must be established to understand and take into consideration in the maintenance planning stage. At the end, the significant relationship will be able to help the industry practitioners in selecting appropriate maintenance strategy with optimal maintenance expenditure, yet improving the maintenance outcome.

Keywords: condition-based maintenance, cost characteristics, maintenance cost performance, Malaysia, scheduled maintenance.

INTRODUCTION

Building maintenance is the combination of technical and administrative actions to ensure the items and elements of a building in an acceptable standard to perform its required function. In order to implement or perform the tasks of building maintenance efficiently, a proper building maintenance management is a necessary tool for it.

Generally, building maintenance is subdivided into two main categories, which are planned maintenance and unplanned maintenance under BS3811 (Seeley, 1987).

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Planned maintenance is the predetermined tasks that are well organised and performed in advance. The maintenance actions reduce or prevent any damage of the components or items. On the other hand, unplanned maintenance is carried out in the event of emergency or contingency maintenance without any predetermined plan. The maintenance actions are carried out after failure or damage detected.

In fact, planned maintenance is supposed to be the major activity in building maintenance instead of unplanned maintenance. Otherwise, frequent breakdown or downtime could be occurred and high maintenance cost is required by unplanned maintenance for repair and replacement works (Chareonsuk et al., 1997). Thus, unplanned maintenance should be minimised to achieve optimal maintenance expenditure.

Since Horner et al. (1997) noted that there are several strategic options available to management and many alternative decisions to be considered for maintaining a building in proper aspect, the comparative study on the maintenance strategies is necessary to control the maintenance performance, especially the maintenance cost.

COST CHARACTERISTICS OF SCHEDULED MAINTENANCE

Hameed et al. (2010) pointed out that maintenance activities performed at fixed time interval are mean to reduce the probability of failures and breakdowns. However, some researchers argued that scheduled maintenance is not cost effective, which the replacement of components is often performed regardless of the condition. Literature indicated that the maintenance performance of scheduled maintenance relies on the criteria as stated below:

Skilled Labour

Since scheduled maintenance is carried out in a fixed time interval, it does require permanent maintenance personnel or technicians to perform the tasks. Commonly, the organisation allocates different amount of salary for the maintenance personnel based on their level of competency. Furthermore, Horner et al. (1997) claimed that the labour is highly demanded for scheduled maintenance activities. Thus, skilled labour is one of the main characteristics to be considered for implementation of scheduled maintenance.

Spare Part and Material

According to Horner et al. (1997), spare part and material is much required for scheduled maintenance compared to other maintenance strategies. Some parts of building systems or services need to be replaced with a new one in fixed interval as determined in the schedule maintenance program, no matter such items are damaged or not. In addition, the quality of spare part and material always has an impact towards maintenance performance (Ali et al., 2010). Thus, the selection of spare part and material should not only concern about cost saving, the quality of spare part and material is another essential aspect to be taken into consideration.

Predetermined Interval for Maintenance

The interval of maintenance activities is critically influencing the maintenance outcome. Narayan (2003) proven that unavailable or delay to perform maintenance task at the right time may cause further damages to the system components. Meanwhile, Yang (2004) argued that the scheduled maintenance programs might not

be able to avoid the risk of failure occurred on system components before the fixed replacement time. This problem occurs due to unknown condition of the system components. Hence, an adequate maintenance interval must be identified and performed to enhance the effectiveness of scheduled maintenance.

Maintenance and Failure Downtime
Since Yang (2004) had mentioned that the scheduled maintenance is not able to prevent the risk of failure, the downtime and cost allocation for maintenance and failure should be considered when planning the maintenance approach. According to Zuashkiani et al. (2011), breakdown may cause collateral damage in a particular system. Relatively, additional downtime and cost will be incurred for the failures occurred before the predetermined maintenance time. Hence, the amount of downtime for maintenance and failure must be taken into consideration for the planning and execution of scheduled maintenance activities.

COST CHARACTERISTICS OF CONDITION-BASED MAINTENANCE

Condition-based maintenance is aimed to minimise the total maintenance cost by collecting and gathering the condition data of the building systems, especially those critical components. However, the maintenance strategy might not be applicable to all building systems or assets in terms of the availability of such maintenance technology and cost effectiveness (Horner et al., 1997). The characteristics of condition-based maintenance toward maintenance performance are stated below:

Skilled Manager
This maintenance strategy requires vigorous analysis on the data and information of systems condition and reliability, as well as financial maintenance data. Meanwhile, building managers must have proper understanding on the failure modes and rates, asset criticality, and other significant factors while implementing condition-based maintenance (Ellis, 2008). Thus, a skilled manager is required to ensure the success of the maintenance strategy.

Monitoring Equipment and Technique
According to Edward et al. (1998), there is a wide range of techniques to examine the condition of specific items or assets, such as oil analysis, vibration monitoring, thermography and so on. Specific measuring and monitoring equipments are required by expertise to perform the maintenance tasks. The tools might be complicated and costly for an organisation (Carnero, 2006). Therefore, the availability of monitoring equipments and capability of the maintenance personnel to use the equipments should be taken into consideration for condition-based maintenance.

Acquisition of Data and Information
Bevilacqua and Braglia (2000) argued that the data and information acquisition systems are the necessary applications to perform condition-based maintenance. The documentation and record of information are essential to ensure the reliability of information about the conditions and remaining lifetime of system components. Ali (2009) further explained that the conditions of buildings and systems must be considered to allocate adequate maintenance cost. Thus, the maintenance personnel should acquire the data and information regarding the conditions of building system components.

Frequency of Monitoring and Inspection

Condition-based maintenance can only be implemented with proper system monitoring and inspection. Hameed et al. (2010) demonstrated that planning of appropriate maintenance activities prior to failure and maintenance cost is greatly influenced by the ability to monitor and inspect the condition of systems. Thus, it is necessary to identify the optimal frequency of monitoring and inspection, so that condition-based maintenance can improve the performance in term of cost-effectiveness.

RESEARCH METHODOLOGY

This research was conducted through literature review in early stage. The cost characteristics of scheduled and condition-based maintenance were identified by reviewing the journal articles and other reliable reference sources. Then, quantitative approach was adapted to study on the relationship between characteristics of maintenance strategies and maintenance cost performance. Questionnaires were sent out to the relevant expertise in Klang Valley, Malaysia to obtain the factual data for analysis, such as building or maintenance manager, building executive or supervisor, and other maintenance personnel. At the end of the research, Spearman's rank correlation analysis results were produced by using SPSS to show the relationship between characteristics of maintenance strategies and maintenance cost performance.

FINDING

In this research, the number of valid return questionnaires was 120, which is 30 per cent of the total research population. Thus, the results were able to represent the research population.

Table 1: Job title of respondents

Job Title	**Frequency**	**Percentage (N=120)**
Building Manager	57	47
Building Executive/ Supervisor	43	36
Building Technician	12	10
Others	8	7
Total	**120**	**100.0**

Table 1 indicated that the respondents of the questionnaire survey comprised building managers, building executives or supervisors, building technicians, and others. Based on the data obtained through the survey, some of the respondents, who selected the category of "others", were either managing directors of a property management firm or mechanical and electrical engineers.

Table 2: Correlation between characteristics of scheduled maintenance and maintenance cost performance

Characteristic	**Maintenance Expenditure Variance**
Skilled Labour-Skill and Knowledge	**-.417****

Skilled Labour-Number of Labours	-.182
Spare Part and Material-Level of Stock	**-.255***
Spare Part and Material-Quality	**-.327****
Predetermined Maintenance Interval-Length of Interval	**.301****
Failure and Maintenance Downtime-Amount of Downtime	**.207***

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

In schedule maintenance, the quality of work provided by the maintenance labour directly influences the maintenance performance outcomes (Groote, 1995). The statement was proven by the analysis result. According to the correlation analysis result obtained as shown in Table 2, the skill and knowledge of maintenance labour was found to be significantly correlated to the maintenance expenditure variance. The labour without proper skill and knowledge are more likely to misjudge and misinterpret the condition or problem of a system. The repair and replacement works done by such labour might not be appropriate. As a result, further damages will be occurred and additional repair works will be required. As such, the task spends additional maintenance cost and leads to the issue of over-budget.

Then, level of spare part and material stock is another aspect highly concerned in scheduled maintenance. Greater amount of spare parts are needed to replace the existing parts compared to other maintenance strategies. In this research, the level of spare part and material stock was found to be significantly correlated to the maintenance expenditure variance (see Table 2). The analysis result supported the statement of Tsang (1995) that accurate spare parts identification and stocking help to control and reduce the operation and maintenance cost. For example, the maintenance personnel will be urged to order small amount of spare parts to execute the maintenance works when there are no adequate spare part stock. It usually costs higher to order small amount of spare part instead of large amount. As a result, the variance of maintenance expenditure occurs.

Furthermore, the analysis result supported the statement of Ali et al. (2010) that the quality of spare part and material always has an impact towards maintenance performance. The result indicated that the quality of spare part and maintenance expenditure variance were significantly correlated (see Table 2). Hence, the statement of De Silva and Ranasinghe (2010) was supported, which revealed that good quality spare part and material can optimise the maintenance expenditure. Poor quality spare part and material is likely to damage and cause unwanted failure to the building systems. Thus, additional repair and replacement works are required. Extra maintenance expenditure is needed and variance of maintenance expenditure is happened.

Meanwhile, length of predetermined maintenance interval is vital aspect to be considered in scheduled maintenance. The length of fixed maintenance interval was significantly correlated to the maintenance expenditure variance (see Table 2). The correlation analysis result supported the statement of Narayan (2003), which proved that delay or unavailable to perform maintenance work at the right time may implicate further damages or defects to the system components. Thus, additional repair and replacement costs are required to restore the system back to its acceptable operation

standard. Nevertheless, optimal maintenance interval must be achieved. Although frequent maintenance is able to enhance the quality of a system, it is costly at the same time (Moghaddam and Usher, 2010).

Besides that, proper planning for the downtimes is necessary to retain and improve the maintenance performance. The amount of failure and maintenance downtimes was significantly correlated to the maintenance expenditure variance (see Table 2). The statement of Chareonsuk et al. (1997) was supported, which stated that the downtime might be very costly. The maintenance expenditure is likely to be varied as more downtimes occur in a building system. Therefore, the downtime for maintenance must be well managed to avoid unnecessary cost. Minimal failure and maintenance downtimes should be obtained in building maintenance.

Table 3: Correlation between characteristics of condition-based maintenance and maintenance performance

Characteristic	**Maintenance Expenditure Variance**
Skilled Manager-Skill and Knowledge	**-.276****
Equipment and Technique-Availability	**-.350****
Equipment and Technique-Capability to Adopt	**-.240***
Acquisition of Data-Reliability	**-.394****
Monitoring and Inspection-Frequency	-.138

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

In condition-based maintenance, skilful and knowledgeable maintenance manager is needed for allocating appropriate manpower, providing training, monitoring the system conditions, as well as supervising the execution of inspection and maintenance works. The analysis result as shown in Table 3 stated that the level of manager skill and knowledge was significantly correlated to the maintenance expenditure variance. Condition-based maintenance is meant to prevent system failure by monitoring the system condition and restoring the system to its required standard before failure occurs. When a manager does not have sufficient skill and knowledge to adopt the condition-based maintenance effectively, defects and failures are likely to occur. Thus, additional maintenance cost will be required for the repair works. As a result, the exact maintenance expenditure varies from the planned maintenance expenditure.

Additionally, the availability of condition monitoring technology may help to improve the maintenance outcome. It was found that the availability of equipment and technique significantly correlated to the maintenance expenditure variance (see Table 3). Since Tsang (1995) mentioned that the availability of reliable monitoring and inspection technology is one of the factors to be concerned in condition-based maintenance, the selection of monitoring equipment and technique must be suitable for the monitoring and inspection of building systems. Therefore, the probability of system failure is minimised. The maintenance expenditure variance is prevented as well because emergency repair cost is reduced.

Meanwhile, specific monitoring and inspection tools and equipment require the expertise to operate and use them in condition-based maintenance. The capability to

adopt equipment and technique was found to be significantly correlated to the maintenance expenditure variance (see Table 3). According to Carnero (2006), it is complicated and costly for an organisation to acquire the condition monitoring tools and technology. If yet, the maintenance personnel are not capable to utilise those tools and technology, more maintenance issues might be occurred. Additional maintenance cost will be needed to solve the problems. Therefore, the exact maintenance expenditure varies from the planned one.

Furthermore, system condition data and information is one of the most important aspects to be considered in condition-based maintenance. In this maintenance strategy, the maintenance tasks such as replacement works are implemented when the parts are almost end of their lifetime by referring to the condition data. The reliability of data and information was found to be significantly correlated to the maintenance expenditure variance (see Table 3). The primary aim of condition-based maintenance is to prevent failure occurs by monitoring the condition of building systems. Basically, emergency repair cost will not be allocated in planning stage of this maintenance strategy. However, when the obtained system condition data is not reliable and accurate, the occurrence of sudden breakdown may not able to be avoided. As a result, additional maintenance expenditure is required for the repair work and it varies from the planned maintenance expenditure.

CONCLUSION

The significance in selecting appropriate maintenance strategies to improve maintenance performance should be emphasised in maintenance management. Through examination of literature, the characteristics of scheduled maintenance and condition-based maintenance were found to be directly influencing the maintenance cost performance. Therefore, it is important to understand the influences of the characteristics in whole maintenance process, which is from planning to outcome of maintenance. In this research, the Spearman's rank correlation coefficient detected significant correlation between characteristics of maintenance strategies and maintenance cost performance. Thus, those significant characteristics as stated below should be taken into consideration in planning and execution of maintenance program:

Characteristics of scheduled maintenance:

(a) Level of skill and knowledge of labour
(b) Level of stock of spare part and material
(c) Quality of spare part and material
(d) Length of predetermined maintenance interval
(e) Amount of maintenance and failure downtime

Characteristics of condition-based maintenance:

(a) Level of skill and knowledge of manager
(b) Availability of equipment and technique
(c) Capability to adopt the equipment and technique
(d) Reliability of system condition and maintenance data

As a conclusion, the research result would allow the practitioners, such as maintenance personnel or organisation to be clear on which aspect of maintenance strategies they should concern in maintenance activities to improve the maintenance cost performance.

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HOW TO MEASURE PRODUCTIVITY: A REAL POSSIBILITY

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ABSTRACT

Although there are numerous ways to quantify loss of labor efficiency, they have failed in several aspects and disappointed expectations for not being rigorous. The quality of productivity measurement is directly associated with the quality of improvement actions. This paper presents an innovative tracking model of data on work hours and units of outputs in construction projects. The tool developed for that purpose is presented briefly. Its use offers new possibilities for productivity metrics, as productivity indices are determined according to the concept of stratification of productivity. The success of the proposed model is corroborated by the results of its implementation in the major oil and gas company of Brazil. The studies of construction gain a new perspective about productivity management.

Keywords: Labor Productivity, Measurement, tool

INTRODUCTION

Dealing with labor inefficiency is generally seen as a quite difficult task. Although there are numerous ways to quantify labor efficiency loss, they have failed in several aspects and disappointed expectations for not being rigorous.

As industries need to improve their productivity, measuring is necessary. However, the method of measurement needs to be carefully conceived and designed, so that the complexity of construction projects is considered. In accordance, Caldas et al. 2010 makes the following remark: “Therefore, to improve the productivity of any onsite operation, it is important to rapidly record relevant data on utilized resources and methods in the operations and the output quantities produced by the operations. Timely and accurate productivity information brings an immediate awareness of project specific issues to construction management, and empowers construction management to take prompt corrective actions, thus avoiding costly delays. There is sufficient evidence to suggest that onsite productivity measurement is the premise for making any productivity improvement decisions.”

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The choice for an appropriate method of measurement is a challenge, as "most of these methods are manually intensive, resulting in relatively outdated information and expensive data collection systems" (McCullouch 1997; Cheok et al. 2000). Gouett et al. 2011 argues that metrics – such as labor productivity - have been criticized because they are often calculated weeks or even months after the work has been completed, once reports from the superintendents are received. That kind of measurement does not enable the correction of problems while work is evolving. Results frequently come when the project is well off schedule and budget.

In general, delays in responding to claims, high operational costs and insufficient information are some of the criticisms made to most common metrics that address productivity, and this is the case of labor productivity as well.

Whenever labor productivity is measured in construction, variations are identified; so understanding those variations is fundamental for any process of productivity improvement. Nevertheless, all productivity methods are limited to the only purpose of releasing the productivity value. The clues to understand the variations are part of another information package, usually obtained by means of interviews, observation etc. Associating that information with productivity is a hard task.

It would be easier if the factors that influence productivity and, thus, cause variations were presented separately for identification and treatment. It would be even better if the impact of each level could be measured, as Caldas point out "in order to understand the factors that affect productivity, there must first be an effort to track it" (Caldas et al. 2010). The motto "get measured to get improved" applies in this case, as it suggests that every process of improvement necessarily requires a robust metrics system.

The present authors understand that measurement quality is directly associated with the quality of improvement actions. In this work, a robust measurement system is presented and discussed in light of a crucial concept: "Stratification of Productivity". This metrics system promises various new management perspectives, to be discussed in future works.

OBJECTIVE

The objective of this paper is to present an innovative model of tracking of work hours and units of outputs in construction projects. With this model, the present authors aim to respond to the criticisms made to obtaining of metrics.

Data collected by the model allow for the stratification of labor productivity (Araujo et al. 2012). This concept is the basis of the productivity management model (Araujo et al. 2011), developed by the authors of this article with the support and endorsement of a major Brazilian company.

In addition, this article is aimed at demonstrating the viability of this tool in construction sites, taking into account the figures that corroborate its dissemination in that major Brazilian company.

BACKGROUND

A considerable effort has been invested in the promotion of techniques for the evaluation of labor activity as tools for the productivity treatment. Work sampling techniques are an example of those efforts.

Lately, research work has been revisited (Picard and Seay Jr. 1996; Jenkins and Orth, 2003; Picard 2004), resulting in proposals to treat productivity improvement by applying work sampling. Even more recently, Gouett et al. 2011 presented the Activity Analysis model as a continuous productivity performance improvement process. Companies have made public the use of this model (Toon 2011) and their satisfaction with its results.

In general, there seems to be a movement of academia and companies towards adopting the model of activity analysis to support their programs of productivity improvement. The motivation for the use of this model is in part attributable to the difficulties of construction companies in executing metrics.

The present authors, however, having a 10-year experience with research about productivity in Brazil, agree with Thomas 1991 on what he proposes: "direct-work percentages from work sampling studies cannot be used to predict labor productivity measured as the work hours per unit of output."

New automated tracking systems (Chi and Caldas, 2012; Lee et. al. 2012; Caldas et. al, 2010; Bohn and Teizer 2009) are promising, but they still require a long trajectory of development to become an effective tool. Yet, they incur the risk of never being capable of tracking information with the desired level of detail, which could only be achieved with human intervention. The high complexity of construction sites, their big dimensions, the impossibility of limiting or restricting areas are some of the aspects that invalidate the use of automated tracking techniques.

The present authors adopted the premises of the Factor Model (Thomas and Yiakoumis 1987) to approach labor productivity in 2007 (in the beginning of this research) believing it was the most appropriate model to measure and improve productivity.

However, the model has one limitation, as Caldas et. al 2010 illustrates: "because of the manual efforts required in input and output quantity collection, the productivity information in the project level information systems is often slowly updated (every one to two weeks), leaving such systems only suitable for the purpose of macro project control, such as cost tracking, and impractical for supporting rapid response to problems that cause productivity loss in ongoing operations."

This article will demonstrate how that limitation was removed.

CONTEXT OF THE STUDY

In 2007, the authors of this article started to develop a tracking model guided by one critical premise for an appropriate management model: the productivity indicator must respond to stratification (Araujo et. al. 2012). The tracking of inputs and outputs must allow for an overall U.R. value as a sum of fractions, in accordance with the concept of "productivity stratification".

That concept responds to one of Thomas' questions: the difficulty to interpret the actual productivity curve (i.e. the one that considers the presence of all the factors at the same time).

The author argues that if those factors could be discounted from the actual curve, an ideal curve could be obtained, representing the reference productivity for a certain service (Thomas and Yiakoumis 1987).

Thus, a tracking model, inspired by that premise, was developed, applied and validated within three research projects. Those projects were established with the major oil and gas company in Brazil and had the purpose of measuring labor productivity in critical construction processes. Those projects were named IPOP I, IPOP II and IPOP III and took place from 2007 to 2009.

The results impressed the company not only for the figures, but also for the quality and potential of the information released.

For the two universities, State University of Rio de Janeiro and Federal University of Rio de Janeiro, involved in the research project, a new challenge was posed: systematize the tracking model so as to make it an effective productivity measurement tool. By 'effective', we mean that this tool would have an extended use, not limited to experimental purposes, which lead to slow response time and require a highly qualified team.

The present authors' extensive experience with tracking of field data motivated a new invitation for a new research project.

By the end of 2010, a powerful tracking model, previously validated through a pilot test, was presented to the partner company.

PRELIMINARY CONSIDERATIONS

The tracking model was developed to be used in all the steps of a construction project. The only condition for its effective implementation is that 'inputs' and 'outputs' be clearly identified and, therefore, be susceptible to tracking.

Inputs include the resources to be transformed (material) and the transforming resources (labor and equipment). Particularly, transforming resources are tracked by measuring the amount of resources by the period of time during when they are available. For example, for the labor resource, inputs are commonly measured by the number of men multiplied by the amount of hours during when they were available to work. Those inputs are conventionally identified as "Workers x hour", or simply "Wh".

Given the need to standardize the productivity indicator and to allow for its stratification, it is important that the tracking of "workers" and "hours" follows a set of definitions.

Regarding the tracking of Workers, the convention to determine the U.R. presented in the previous literature are respected (Thomas and Kramer, 1987; Thomas et. al. 1990). For instance, only Workers who belong to the direct production staff or "direct labor" are considered.

As for the tracking of hours, the only premise adopted from productivity management manuals is that the hours available to work be considered.

The tracking model advanced as it reviewed the procedure to track the hours available to work. Along the day, "Workers available to work" conduct diverse activities. Tracking the time spent in each of those activities then becomes the main premise for the tracking of hours in the proposed model.

Thus, instead of tracking just the available hours (h), the "Hours Spent by Activity" are tracked. That new proposal is the main driver for the application of the productivity stratification concept.

It is important to mention that activities must be previously defined. Thus, the observer will be able to register data respecting the existent classes of activity.

In order to structure and standardize the "Hours Spent by Activity" tracking, an "Activity Analytical Structure" – AAS – is generated. The AAS is a labor stratification tool that considers the activities identified by the observer. It is structured as a hierarchical tree (from the most general activity to the least one), taking into account the usual activities of a work day.

The AAS should be developed aiming at:

i. respecting the first level of occupations (ID1), composed of seven classes of activity, which are a standard for all and any production process to be monitored;
ii. decomposing each ID1 category hierarchically in secondary levels of activity, hereafter called ID2, ID3....IDn, with the purpose of identifying the termination activities (i.e. those that "reveal" the activity with which workers are involved at a painstaking level of detail).
iii. facilitating the understanding of the sequence of activities typical of a day of work, serving as a powerful communication tool.

First Level of Activities

The seven classes of standard activities were defined and delimited in a period of two years of work, involving exhaustive field applications, debates with specialists, etc. The seven categories of the ID1 are, therefore, fully validated. Figure 1 illustrates a hypothetical work day, with the tracking of hours by class of primary activity. This example shows the seven categories of ID1 as indicated by the tracking model.

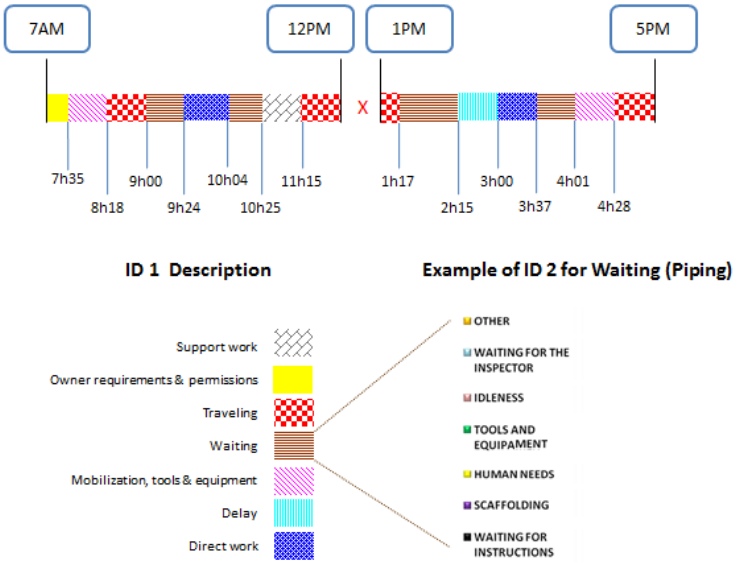

Figure 1. New proposal of work hours tracking.

Class of Secondary Activities

From the first level, the seven classes of activity are subdivided into secondary classes, which gain particular characteristics according to the construction process. The secondary classes can be subdivided until a "terminal activity" is reached, which provides a maximum level of details about the activity with which "Workers" are involved.

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As each construction process has specific characteristics, its classes of secondary activities are unique. However, from the moment an AAS is defined for a certain process, it should not change, not to hamper future comparisons. The AAS should be documented and preserved by the company. Figure 1 shows an example of secondary class (ID2) for the ID1 "Waiting" – in this case for the assembly of piping.

PRESENTATION OF THE TRACKING MODEL

The Tracking Model is implemented by means of a software specifically developed for the purpose: "PRODCAT". This software was developed in Microsoft .NET and runs in mobile devices (PDAs) in the Windows Mobile operating system.

The tool is operated by professionals of a technical level, previously trained to deal with the following items: i) the functionalities of "PRODCAT"; ii) the characteristics of the process phase that will be monitored; ii) the corresponding analytical activity structure (AAS). The training of these technicians, including the implementation of a pilot tracking, takes three days.

After the construction process and phase to be measured are defined, the technicians start an intensive monitoring of the staff of workers involved.

The definition of the size of the sample (n) considers the following items: i) identification of the total amount of workers in the professional categories that will be monitored; ii) estimation of the number of days that will be tracked; iii) total hours of the amount of workers to be monitored – Population Size (N). The following statistical premises are considered: i) proportion of the occurrence of the event: 50% - p = 0.50; ii) proportion of the non-occurrence of the event: 50%: (1-p) = 0.50; confidence level (d) at 95%: d = 1.96; sampling error (e): 5%: e = 0.05, along the work day.

The focus of the tracking is on the staff of workers, which is chosen randomly (among the staffs that are suitable for the phase/process concerned) in the beginning of the day.

"PRODCAT" is used to collect the hours available to work of all the workers of the staff under monitoring (considering the activity with which workers are involved in each moment); the service accomplished by this staff; the content and context factors; and the daily disturbances. Figure 1 shows some of the main screens of "PRODCAT". The central screen is highlighted.

All and any change of activity of each component of the staff along the work day is registered (Figure 1-A). Whenever one or more components of the staff engage in the "service" activity, the observer identifies the type of work being executed, considering a pre-list of possible outputs (Figure 1-B). Whenever there is a modification of one or more context /content factors during the work day, the observer registers the change (Figure 1-C). All and any abnormality along the work day is registered in the observation field (Figure 1-D). New workers, who become components of the staff along the work day are added (Figure 1-E).

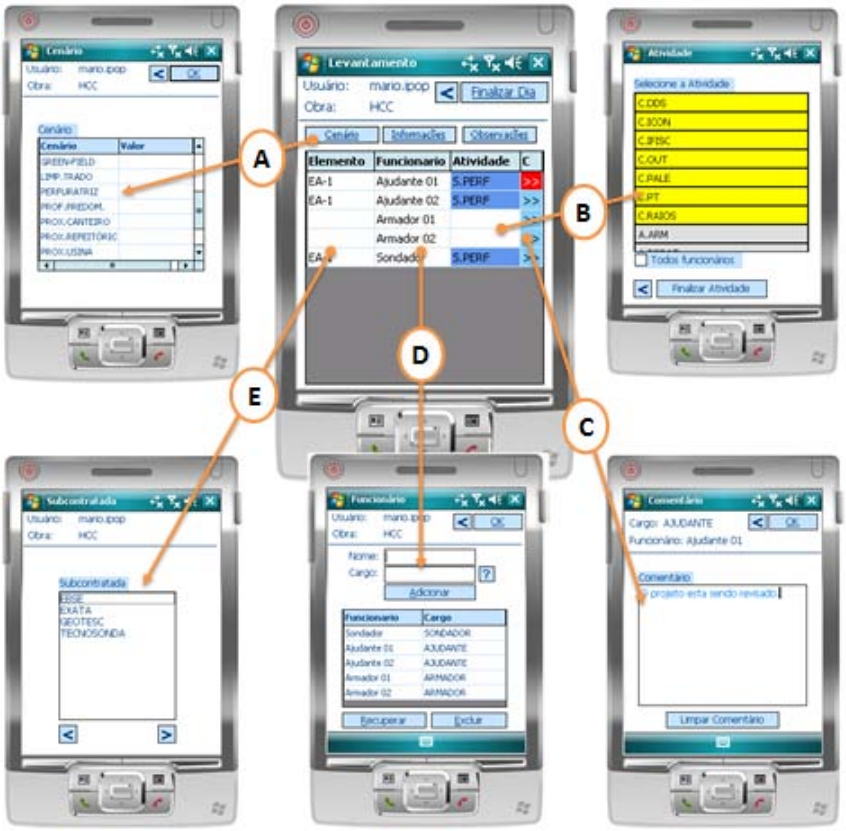

Figure 1 – Main screen of PRODCAT

At the end of the day, the technicians upload the file via a wi-fi network. Upon the completion of the upload process, the productivity of the day can be analyzed by means of reports automatically generated via a specific web system (to be examined in a future article). Some of the data from those reports are presented below.

EXAMPLES OF INFORMATION MADE AVAILABLE

In Figure 2, labor productivity (piping assembly) collected on the day "n" was 21 Wh/joint. The graph shows the labor productivity rate in further detail. Analyzing the metrics, one can see that 8 Wh were spent in service; 2, in delay; 3, in mobilization; 3, in tools & equipment; 10, in waiting; 3, in travelling; 1, in attending owner requirements and instructions; and 1 Wh in support to do one joint.

Caution with each activity seems to favor the improvement of productivity. It is import to highlight that the stratification of the productivity rate into further levels of activity can be obtained for any period of time monitored by means of the PRODCAT. The information is not limited to the first level of activities. For example, if the fraction corresponding to "waiting" is exerting a major impact on the composition of the indicator of productivity, the tracking model allows for the investigation of the most representatives reasons for the interruptions.

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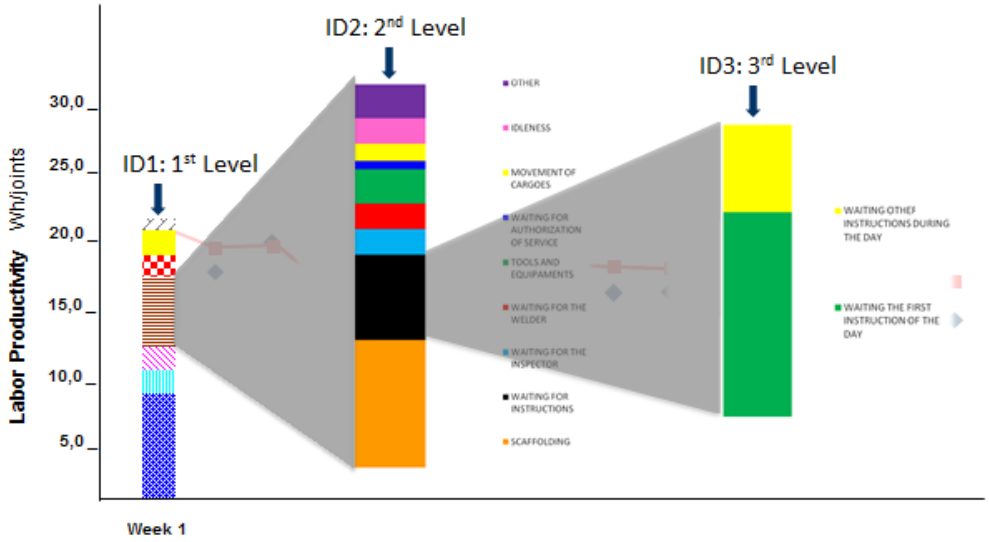

Figure 2 – Stratification of labor productivity

Each indicator of productivity brings a set of data pertaining to the work performed (Figure 3). It is the content factors - piping diameter, material and welding processes for piping assembly - and the context factors, as show in Figure 3, that will contribute to the understanding and interpretation of labor productivity.

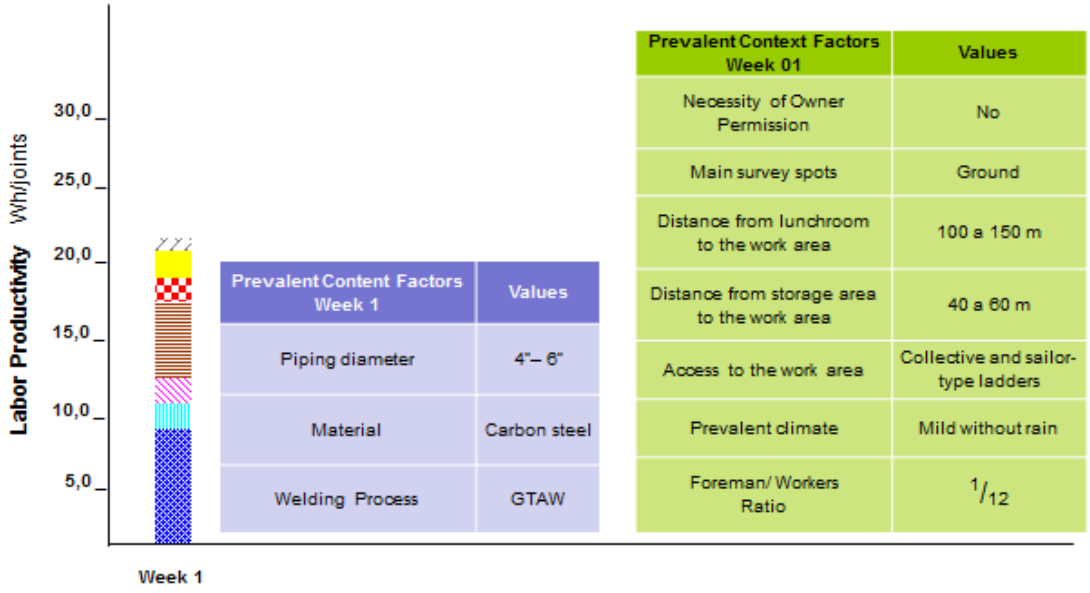

Figure 3 – Prevalent Content and Context Factors of week 1

CONCLUSIONS

It is important to mention that all the processing, as shown in Figures 2 and 3, is done in a system specially developed for this purpose. Thus, the period of time elapsed from the tracking of data in the field to the availability of information processed takes a few minutes. This makes productivity management more dynamic.

The tracking model presented in this article is an important tool for productivity management, because of the following characteristics: i) it adopts and respects the premises of the Factor Model as a methodological framework; ii) it facilitates the interpretation of productivity curves; iii) it enables the stratification of the

productivity indicator (a requirement for productivity management programs); iv) it endows the productivity indicator with the capacity of being "self-explanatory"; v) it automatically aggregates content and context factors to the productivity indicator, what is fundamental for the understanding of occasional variations; vi) it enables comparability and productivity analyses.

The PRODCAT has been used since January of 2010 by the Brazilian company that was a partner during its development. In May of 2012, more than 50 technicians used the tool daily. Up to May 2012, the company estimated more than 160 thousand work hours tracked in accordance with the model proposed in this article. In general, the tool has contributed for the understanding and improvement of productivity in the company's ongoing construction works.

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INTRODUCING A NEW METHODOLOGY TO MITIGATE SCHEDULE DELAY DAMAGES

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ABSTRACT

Problems in making deadlines are frequently considered a case of lack of resources in Brazil rather than a case of inefficiency in the use of available resources. The present authors defend that unproductivity should be targeted in order to mitigate construction delays. A new model to manage labor inefficiency in construction sites is presented in this article in light of the new concept of productivity indicator stratification. This concept enables the demonstration and quantification of the causes of inefficiency in the use of labor. Two real cases, resulting from two research projects conducted with the largest company of Brazil, are analyzed in the article. They reveal that productivity management, if properly treated, contributes to the management of deadlines in construction projects and, therefore, to the minimization of schedule delay damages.

Keywords: Labor Productivity, Scheduling; Construction industry; Delay time.

INTRODUCTION

Schedule delays in construction work can cause considerable financial damage. For clients, delays in inaugurating industrial plants lead to major revenue losses. For contractors, schedule delay losses cause both financial damage and annoyance as a consequence of claims from clients. In general, delays lead to “late completion, lost productivity, acceleration, consequential damages, increased cost, and contract termination” (Ardit and Pattanakitchamroon, 2008).

In Brazil, problems in making deadlines are frequently considered a case of “lack of resources rather than a case of inefficiency in the use of available resources” (Araujo et al. 201, work presented in the CII Annual Conference). However, increasing the amount of resources has proved ineffective to respond to problems with deadlines in the Brazilian reality due to the lack of qualified and available labor and to the increase in costs and complaints.

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Particularly, among the most relevant reasons for delays in construction – the lack of qualified labor, inefficient technology and poorly detailed execution projects – the matter of labor efficiency stands out. In recent studies, there has been some emphasis on the fact that "schedule delay damages and losses of labor efficiency go hand-in-hand" (Thomas 2010).

One of the most common metrics to describe labor efficiency is the "labor productivity" (the ratio of work hours to units of output). But this metric has been criticized because it is often calculated weeks after the work has been completed, when the reports from the superintendents are received. The problem of measuring productivity this way is that "areas of low productivity are identified in the site office well after the issue first occurred on-site". Gouett et al. 2011.

OBJECTIVE

Dealing with labor inefficiency is generally seen as the most difficult task in a productivity management program (i.e. a process of continuous improvement of labor productivity aimed at mitigating delays in the finalization of civil construction work). Although there are numerous ways to quantify labor efficiency loss, they have disappointing expectations.

The objective of this article is to present a new model to cope with labor inefficiency, capable of responding to the gaps shown by the literature. This model can determine the causes for inefficiency and quantify their impacts on productivity. It enables the comparability of productivity across projects and the correlation of factors with productivity metrics – crucial capacities for the effective study of labor productivity (Liao et al. 2011).

The article is introductory for it reveals the foundations of this new methodological proposal, already developed, validated and implemented by one of the biggest oil and gas companies of the world.

BACKGROUND

Gouett et al. 2011 presented the difficulties in establishing a robust methodology to measure labor efficiency loss in construction work. Regarding this aspect, Thomas (2010) pointed out that "one reason why it is difficult to recover for loss of efficiency claims is that there is no rigorous methodology for quantifying loss of inefficiency damages". In addition, the author argued that "an important point to remember is that a loss of efficiency study can be subjective and the expert needs time to develop the story of what happened".

Wambeke et al. (2011) discussed the causes of variations in the starting times and duration of construction project tasks and suggested that these variations result in disruptions to the schedule and/or decreased productivity. They argued that "there is a gap in knowledge in terms of identifying the root causes of variation and their magnitude". Through a nationwide survey, they identified the top eight causes of starting time variation and top nine causes of task duration variation. The authors' conclusions benefit managers, as they put forward a set of causes for variations in construction tasks. However, the occurrence and impact degree of those causes vary according to the construction work, processes and phases. It is more effective, then, to know the causes in association with the specific needs of the construction tasks.

Identifying and measuring the real impact of the causes of productivity loss is a gap this article takes into account.

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PRELIMINARY CONSIDERATIONS

In the present days, two primary purposes for measuring productivity are usually taken into consideration (Thomas et al. 1986): (1) to control project cost and schedule; and (2) to obtain data for planning.

The first purpose (Thomas and Mathews 1986) can be easily understood by rewriting the equation that measures the labor productivity rate (U.R.) (Telles et al. 2011).

_____ _____

The U.R. equation can be rewritten as follows:

_____ (02)

Time can be measured by the number of hours spent on a day of work. Thus, the equation can be rewritten once more as follows:

_____ (03)

Or yet:

_____ ( )

For the same amount of service, there would be two ways for reducing task duration: increasing resources – more craftsmen, hours or both – or improving productivity – by reducing U.R. values. The first option has financial impacts and offers no guarantees, since human resources are hard to control. However, this is the common option adopted in Brazil.

In a different direction, the authors of this paper chose to measure labor efficiency to mitigate delays in construction. When challenged by one of the largest companies of the world, the present authors did not hesitate over whether to adopt the factor model as their methodological basis.

To develop a productivity management tool considering the factor model, the main challenge was to develop a tool that: i) could be understood by companies; ii) could be operated by professionals from these companies; iii) presented low operation and implementation costs; iv) provided very rapid and precise responses to construction work managers.

After over two decades of research to validate the factor model (Thomas et al. 1990), the authors start corroborating a possibility put forward by Thomas et al. 1990: “The factor model **is** the best tool currently available for studying the causes of productivity.”

Need for a New Approach

The literature on labor efficiency loss emphasizes that measuring the influence of productivity factors is equally important and difficult. The main difficulty is associated with the isolation of the factors and their separate treatment. Another difficulty lies in the identification of the impact of each factor, since the level of this impact is not constant. For instance, a contextual factor such as temperature in the

work environment is perceived differently by different people, exerting diverse influences on productivity.

Case 1 (see Figure 1) illustrates the fact that knowing and measuring the influence of factors could explain the unit rate (U.R.) variations.

In this case, labor productivity related to a certain service was measured in five different construction sites (Figure 1, represented by letters A, C, D G and H) with very similar characteristics - phase, size and typology. The construction projects were controlled by the same company, presenting identical execution procedures and similar quality, safety, environment and health demands.

The variation among the different construction sites (Figure 1) is substantial – representing 80%. It is not possible, however, to conclude for the worst productivity level based on the graph information. The highest value of UR is not necessarily associated with the worst productivity – a possible assumption in a first analysis.

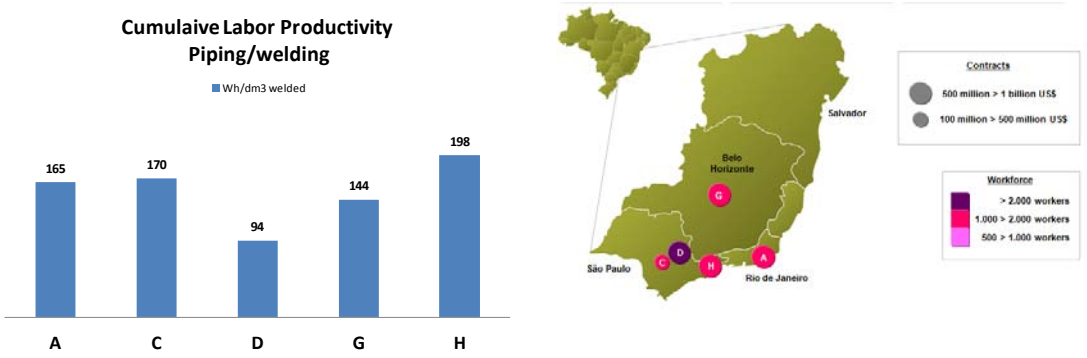

Figure 1. Case 01: U.R. variation in different construction works. Source: Telles et al. 2011

In Case 2 (see Figure 2), variations from potentially influencing factors are not significant. Nevertheless, there is a significant variation in U.R. values (Figure 2). This case illustrates that an important premise of productivity management is to consider labor in the estimation of productivity losses, when those losses occur in environments that were not influenced by content and context changes.

The productivity in the root pile execution process was measured by a group of properly prepared technicians for 65 days. The geological profile of the area presented minimum variation. The diameters of the piles did not change during the monitoring period. The group of workers remained constant; none of them were replaced in the period. The drilling equipment and the equipment for the injection of grout remained the same. Climate conditions did not change considerably.

In short words, the surrounding conditions, herein presented, remained unchanged from the beginning to the end of the period during which productivity was measured. Figure 2 presents the daily U.R. values determined in the period.

The U.R. variation along the days is dramatic – a difference of 300% between the lowest and the highest U.R. values. The inefficiency in the consumption of resources is clearly demonstrated.

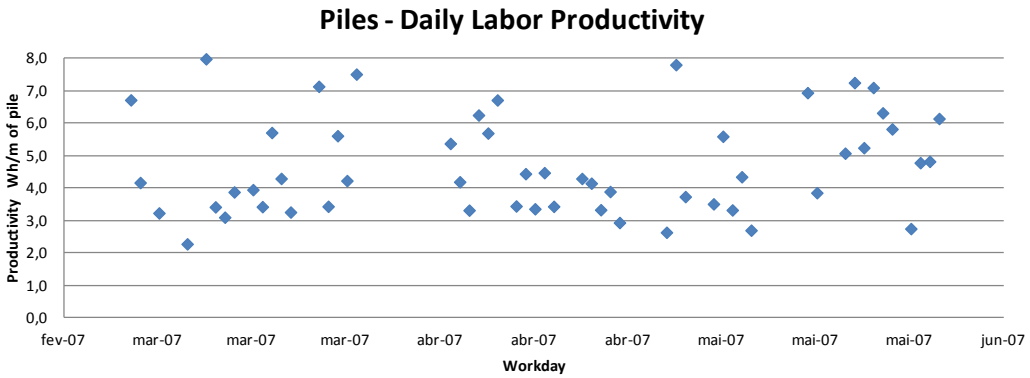

Figure 2. Case 02: daily U.R. variation in the same site with little variation in the surrounding conditions

The two cases demonstrate how necessary it is to understand the reasons why the productivity indicator value changes. Some questions should be particularly investigated: (1) Could the highest, and consequently worst, U.R. values, be mitigated? (2) What is necessary to obtain the best U.R values more frequently, provided that their obtaining has been proved feasible? (3) What is the path to obtain practical and rapid responses, avoiding an exhaustive search for explanations? (4) From what point could managers start addressing the U.R. variations reported in case 2, for example?

NEW APPROACH

The Construction Industry has specific characteristics when compared with the traditional Manufacturing Industry. In a factory, workers find a pre-prepared environment, with the inputs, equipment and instructions necessary for the task execution. Workers hardly ever leave their work post – just for physiological needs.

The environment of the Construction Industry is totally different. Inputs and equipment may not be available, and workers may leave their work post to obtain resources. In addition, interference from simultaneous activities may interrupt tasks temporarily.

The cases studied herein are examples of the following conclusion concerning the construction industry: the time converted in effective service - *the period when workers are found in their work post, putting in their efforts with the only purpose of executing the operation that characterizes the service concerned* - is just a part of the workers' time in a construction site during their work day.

When workers are not directly involved with their main work activities, they are involved with complementary and/or secondary activities or with no activity at all. Irrespective of the nature of these activities, all the hours spent are measured, considering they constitute the work availability period.

Productivity tracking techniques estimate available hours without distinguishing the type of use that is given to those hours – idleness, effective service, waiting, etc. Eventually, the obtained indicator reflects an overall productivity value, of which interpretation is quite difficult (c.f. cases 1 and 2).

Finding influencing factors, which may explain productivity variation, requires the identification and follow-up separation of productivity fractions not affected by those factors. In order to determine the productivity fractions, work hours (inputs) are tracked according to the nature of activity (Figure 3). This new tracking method,

namely "stratification of productivity" (to be discussed in another article), enables the treatment of productivity as a sum of identified and independently measured fractions, rather than as an overall "closed indicator".

The productivity stratification (see Araujo and Sampaio, 2012) facilitates the identification of influencing factors, and the presentation of U.R. in "fractions" enables the thorough examination of unproductivity, as its exceeding factors are revealed, identified and quantified all at once.

Influencing factors may be specific for each U.R. fraction concerned, or there may be U.R. portions that are not affected by content and/or context factors. For example, if the 'service UR' is isolated, it is possible to know which content factor is correlated with it, or yet, if no influencing factor is correlated with it.

Considering the U.R. presented in Figure 3, the quality of information made available (especially considering it is about the same data presented for case 1) is remarkable. The following readings can be obtained: i) the U.R. fraction potentially influenced by content factors – named service U.R. – presented low variation; except for D. This conclusion is corroborated by the analysis of the service content factors, which remain virtually unchanged among A, C, G and H; ii) the U.R. fractions corresponding to "waiting" are highly significant, surpassing the service U.R. – C and H; iii) the other fractions show the impact over the overall productivity caused by idleness, displacements, monitoring by inspectors, support services.

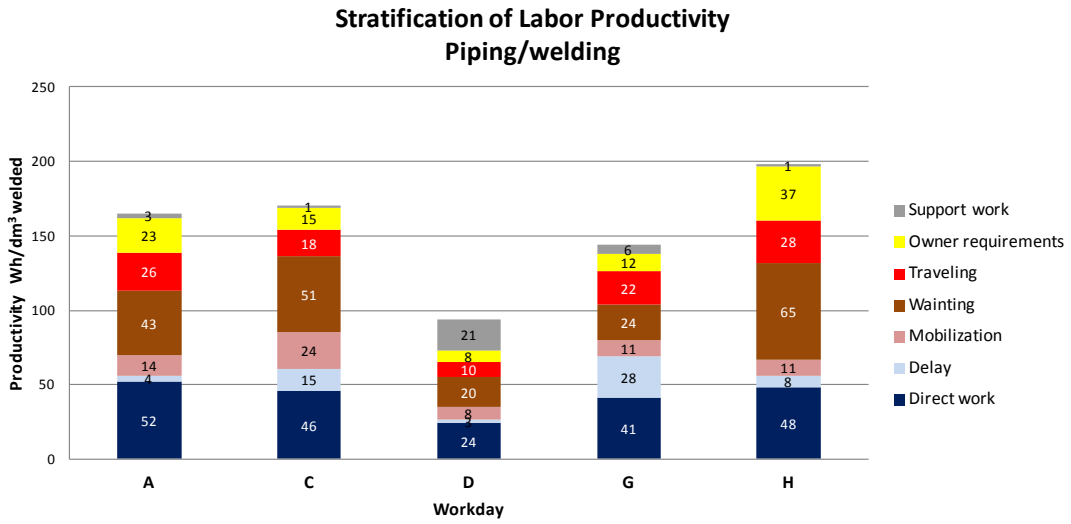

Figure 3. U.R. Stratification

In sum, the new model makes the exceeding factors explicit, favoring actions to reduce the overall UR. The challenges particularly posed by Case 2 can be addressed for each productivity value can be analyzed separately. For a daily value or for an overall value referring to any period of time, the stratification of the indicator enhances the analysis by providing the following possibilities: i) real knowledge of productivity; ii) identification and quantification of unproductivity; iii) identification of the causes and of the responsible areas for unproductivity, etc.

Figure 4 shows the stratification of the cumulative labor productivity presented in Case 2. The main causes of the "waiting U.R." are highlighted.

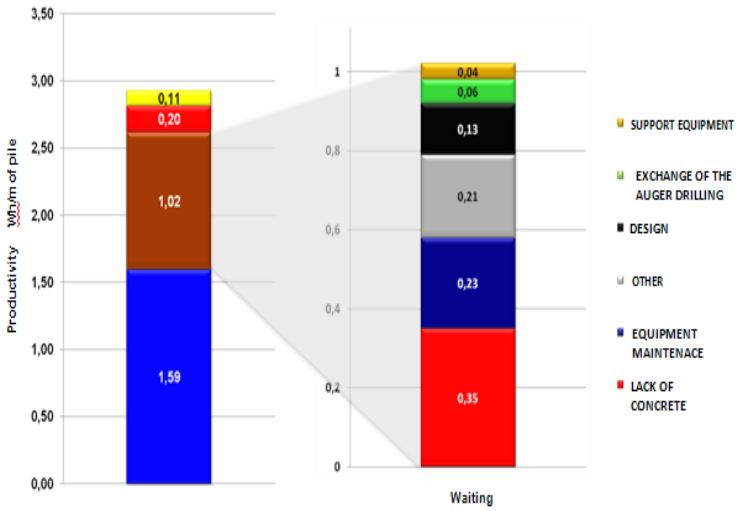

Figure 4. An example of productivity stratification for Case 2

CONCLUSIONS

The productivity stratification reveals virtues and faults of production processes with respect to the efficiency/inefficiency in the use of resources for the generation of goods and services. By doing so, it also reveals the responsibilities and the responsible areas for the rights and wrongs in construction processes.

The model presented in this article proves relevant for labor productivity management and, consequently, for schedule management for the following reasons:

i. It stratifies the productivity indicator – usually "closed" and difficult to be interpreted – in quantifying fractions, organized and structured according to a pre-conceived hierarchical model (analytical structure of activities).

ii. It points to two paths towards the improvement of productivity. One is focused on the treatment of the productivity fraction exceeding factors. The other focus on the identification of influencing factors – positive influences should be replicated and negative influences, mitigated, whenever possible.

iii. It determines and quantifies the impact of labor unproductivity. The productivity fractions, identified as "exceeding factors to be eliminated", that is, "unproductivity", can be analyzed in terms of frequency and relevance, favoring actions towards its reduction.

iv. It identifies those who are responsible for "unproductivity", favoring targeted claims that will result in faster and more efficient responses.

Finally, opinions, pseudo-paradigms, speculations are replaced by safe and exact information, which can be obtained by means of a rigorous and non-biased metrics and which is made available in a simple and objective way.

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MISTAKE-PROOFING: PREVENTING QUALITY FAILURES IN THE UK CONSTRUCTION INDUSTRY

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ABSTRACT

The continuity of fund flow into the UK office and luxury residential markets depends to a large extent on the supply of quality products. The delivery of prized and trophy assets for high-net-worth individuals, Insurers, Private Equity, Institutional and Sovereign Wealth Funds requires robust performance-based quality management processes to be implemented at both organisational and project level. An extensive review of the literature published in the last twenty years on quality management within the construction industry in the UK suggests, that quality management practices in the industry are deficient as a result of limited attention being given to design verification and review processes by design organisations and inadequate reflection after project completion. However, the continuous supply of prime assets suggests, that construction firms involved in their delivery developed robust processes which allow them to overcome the quality problems and achieve the required quality excellence. The applied performance-based quality management systems, which involve the extensive use of samples and mock ups, are linked to the widely implemented, in the manufacturing industry, mistake proofing (Poka Yoke) concept. However the considerable cost and programme implications of their deployment limit their application in the wider construction industry.

Keywords: defects, quality cost, quality management.

INTRODUCTION

The UK construction industry image and its reputation are still deeply rooted in the past (Chomicka 2012). The industry image is equated with the findings of a review of its procurement and contractual arrangements contained in the Latham Report (1994) together with the Egan Report (1998). These reports identified industry practices as being 'ineffective', 'adversarial', 'fragmented', 'incapable of delivering value for its customers', 'lacking respect for its employees' (Latham 1994) and found the industry to have low profitability, too little capital investment, insufficient research, development and training and that too many of its clients were dissatisfied (Egan 1998). Since publication of both these reports, they are widely being referred to in academic research and press reports.

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In the 18 years since the Latham Report (1994), industry practices have changed in line with competitive dynamics and advances in technology (such as the arrival of the internet). There is a constant flow of funds into the UK office and luxury residential markets, which depends to a large extent on the supply of quality products. The UK construction industry successfully delivers prized and trophy assets for high-net-worth individuals, Insurers, Private Equity, Institutional and Sovereign Wealth Funds. This continuous supply of prime assets suggests that UK construction firms involved in their delivery developed robust quality management processes based on methods prevailing in the manufacturing sector.

The adoption of quality management practices used in manufacturing sector and further adopted within the construction industry is not a coincidence. The subcontractors involved in delivery of prestigious office and luxury residential schemes in the UK often come from various manufacturing industries and include, for example, yacht manufacturers. The majority of these companies operate internationally, are not UK-based businesses although some employ a UK-based workforce. On prime and super prime residential project, subsequent trades take possession and sign-off the works of their predecessor and it is not uncommon for example that a specialist painting firm would refuse to accept its predecessor's works (painters or plasterers) if the insufficient quality of preceding trades would compromise the quality of their own works.

The niche prestigious office and prime residential market sector in the UK influenced a shift in the UK construction industry from prevailing certification-based approach to quality towards complex performance-based systems. As part of this shift, a widely implemented mistake-proofing (Poka Yoke) system in the manufacturing industry found its endorsement in the construction industry. As indicated in Dos Santos and Powell (1999) observations, due to the one-off nature of construction industry's products and the specific manner of their assembly, the Poka Yoke approach could not be directly translated into construction. Instead, the concept has been adapted to reflect construction industry-specific circumstances and is commonly found in the extensive use of samples and mock ups on quality-driven projects.

RESEARCH METHODOLOGY

The following two research methods were selected: literature review and review of prestigious commercial office and prime residential case studies. In line with this approach, there are two phases in this study: 1) Investigation of existing research and 2) Exploration and interpretation of specific case studies to complement literature review. There were three commercial offices and four residential case studies (one 'affordable', one luxury, one prime and one super prime) used in this research.

A literature review was chosen as a staring point of this research to establish subject background, learn from other research, formulate research problems and synthesise the work of others. The findings of earlier research was used to analyse the introduced case studies, which were hand-picked by the researchers to best illustrate the link between quality management practices utilised in the manufacturing sector and UK construction industry. The findings of the literature review suggest that there are two main streams of Poka Yoke concept exploration: one focused on achievement of zero defects on completion and the second concerned with 'idiot proofing' of solutions against misuse by the end user. In the light of this presentation size constraints, the

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Poka Yoke devices analysed in this research have been narrowed down to two methods of mistake-proofing to deliver a 'zero defects' product – samples and mock-ups.

QUALITY FAILURES IN THE CONSTRUCTION INDUSTRY

The problem with mistakes (quality failures) exists in every industry; nevertheless the construction industry is constantly being compared in an unfavourable light to the manufacturing industry, and car industry in particular. The construction industry's products are no different to products manufactured by other industries; however, they tend to be much more expensive. Unlike the periodic or temporary extensive editorial criticisms of car manufacturers during their product recall periods, the issue of quality failures in the construction industry is a constant subject of public debate. There are numerous blogs, websites, newspaper and magazine articles and television programmes dedicated to this issue, predominantly in the residential sector setting. The reason for this situation can be found in a number of high profile instances, in which there was a significant amount of quality failures identified in buildings (Sommerville 2007) and a slow response (or no response) from inadequate product providers (developers and contractors). In the UK, over a third of new build houses have between 100 and 200 defects, with the average number of quality failures per home being 62 and there is a suggestion, that 'the problem is getting worse' (NBI 2012).

The definition of a 'mistake' in the construction industry is not an easy task. A review of contemporary research surrounding quality failures within the general construction industry indicates, that there is a wealth of quality failure definitions and terms that are often used interchangeably (Sommerville, et al. 2004). The terms such as faults, repairs (Ashford 1992), quality failures and deviations (Burati, et al. 1992), non-conformance (Abdul Rahman 1993), rework (Love and Li 1999) and defects (Josephson and Hammerlund 1999) are most commonly used in construction literature. A 'mistake' or 'quality failure' in the construction sector does not necessarily mean that something fails to fulfil its function. For example, in one of the researched case studies, the use of a white paint with different reflectivity (20 per cent) on ceiling grill units which when installed were adjacent to ceiling tiles powder-coated with the same white colour (identical RAL) but with 10 per cent reflectivity, caused a perception of a colour difference between grilles and tiles for some of the end users. The perception of a different shade of white was deemed to be a quality failure that had to be rectified by a contractor.

In order to eliminate mistakes, there has to be a process or device that would make it impossible for them to occur. A prevention technique- Poka Yoke, which was developed by Shingo (1986) for a car manufacturer, provides a tool enabling the design and delivery teams in the construction sector to eliminate quality failures.

THE CONCEPT OF POKA YOKE IN CONSTRUCTION INDUSTRY

The car manufacturing industry is renowned for the robustness of its quality management systems and subsequent quality of its outputs, particularly the Toyota Motor Corporation, is often referred to as the exemplar of quality management excellence. Although the amount of Toyota's quality failures in the last three years was substantial (Haq 2010), nevertheless its contribution to the development of

quality management thought and a method of dealing with identified quality failures make it a world-renowned exemplar. One of the most influential contributions was introduction and application of the Poka Yoke idea (Shingo 1986), which translates as 'mistake-proofing', 'fail-safe' or 'avoiding inadvertent errors'.

A Poka Yoke device is any apparatus that either prevents a mistake from being made or makes the mistake obvious at a glance. There were several attempts to investigate prevention techniques such as Poka Yoke effectively implemented to construction tasks in the UK. For example, Spear and Bowen (1999) found Poka Yoke to be 'difficult' to transfer to the construction industry and according to Dos Santos and Powell (1999) 'construction still lacks investigation into the interpretation and adaptation of this common core to its own reality'. However, Pollet and Ryall (2010) have successfully undertaken an experimental case study to investigate the potential of Poka Yoke devices application at a second-tier (subcontractors') level. In their study, electrical contractors produced a device to be used as a guide and template for cutting out electrical back boxes in plasterboard walls to an exact size to ensure that they did not cut an opening larger than required (as historically, correcting such defects has been a very time consuming exercise and involved a number of different trades (Pollet and Ryall 2010).

It is proposed in this study that another practical applications of the Poka Yoke concept in construction: samples (specimens or small quantity of products) and mock-ups (usually full-sized scale model of a structure, used for demonstration, study, or testing) permit to review design functionality, identify any buildability issues, identify opportunities for pre-fabrication, sequencing strategy and the overall quality of the end result before the construction commences. These devices also provide quality standard benchmarks for subcontractors and suppliers and therefore these sub-contractors can be performance measured.

Poka Yoke also involves a change in the mindset of the organisation (Pollet and Ryall 2010), which is particularly important in the current business landscape following the economic downturn. Nowadays, everyone involved in project delivery needs to 'think and act quality' to gain competitive advantage, or even to survive. By demanding an excellent quality end products, clients expect to reduce costs not only in the building delivery processes, but also in building's performance, administration and white-collar services associated with the building management and use (ECH 2011).

MISTAKE-PROOFING IN THE CONSTRUCTION INDUSTRY

The primary purpose of mistake-proofing is delivery of a quality product. There are various definitions of quality in the construction industry and for the purpose of this study quality has been defined as the conformance of the finished product with the contractual documentation, its alignment with projects strategic objectives and exceeding client's expectations. The design and delivery processes in construction are mapped out to meet these requirements and the studied Poka Yoke devices – samples and mock-ups – form part of the wider quality management practice. The extensive use of samples and mock ups has become an increasingly common feature of all construction projects. Samples include, for example, external cladding panels, ceiling tiles, grilles, wall panels and carpet tiles. The examples of mock ups include floor and wall junctions, bulkhead details, blind boxes, shadow gaps, doors (with frame and architraves), toilet or a kitchen. The examples of fully operational mock ups

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(sometimes referred to as exemplary units), which have working ventilation to test acoustics or water supply pressure, include a full radio studio or a fully fitted apartment (to understand spatial relationships, interfaces and performance).

However, the extent and application of these devices depends on the type of construction sector client and the nature of the project to be delivered. For example in the affordable housing sector case study, in line with the design and build procurement selection with an architect being 'novated' to the contractor, an architect designed the external lighting scheme and specified the light fittings. The specification was for a 'preferred product' or 'similar approved' for the contractor to provide. Upon receipt of drawings and specifications, the contractor, in line with prevailing approach, sourced a 'similar' light fitting sample from its supply chain for the architect's approval. The sample was presented to the architect during the weekly design review meeting, over the table, and approved via subsequent e-mail and recorded in meeting's minutes. In due course, the contractor procured the fittings and installed them broadly in line with the architect's drawings. The variation between the designed locations and actual ones was due to the required method of installation of the actual fitting which was not known at the design stage or reviewed beforehand, the location of the wiring 'pulled' by MEP subcontractor (for example 5 cm more to the right), location of the gas meter and many other reasons. On the researched prime residential scheme, the design, specification, procurement and installation of the external light fitting followed a different route. The lighting scheme was designed by a specialist lighting consultant (and in researched prime residential case study there were two separate lighting consultants: one renowned for its expertise in external lighting solutions and one 'guru' in internal lighting design). The external light fitting was selected by the lighting consultant in collaboration with an interior designer, landscape designer, MEP consultant and an architect. The lighting consultant specified a particular light fitting which was then sourced as a sample for review. Two of the proposed light fittings were then installed on the mock-up of the external façade to check, whether they do not create unforeseen issues when used with a particular type of stone, the overall 'feel' and aesthetics of the proposed combination of selected light fitting and type of stone used in façade cladding (which was specified by mineralogist employed by the façade engineer) was assessed. Following the review of a mock up, the façade trade contractor's designers, in collaboration with the architect and MEP consultant, developed production drawings for the façade which included marked up holes in panels to facilitate fittings' installation. The stone-clad façade panels arrived on site pre-drilled to ensure accuracy and achievement of design intent (e.g., the required level of quality).

As can be seen in the example explained above, the relationship between quality, cost and the final price of the finished product is a determining factor when it comes to the deployment of effective Poka Yoke devices. The cost of the exemplary unit assembly is significant, for example the provision of a mock-up for a development of under 80 prime market apartments of a realised average sale value of £2,400 per sq ft (£25.833 per sq m), which was erected in contractor's warehouse within the M25, came with the construction price tag of £184,000 (plus consultants' fees which are difficult to quantify in relation to this item). Although this translated to an average of £2390 per finished apartment, once the cost of all samples which were bought within each package and mock-ups erected on and off site for design review and testing purposes, this sum multiplied accordingly. If we estimate the approximate cost of samples and mock ups on this scheme and all additional mistake-proofing measures such as

appointment of specialist consultants who are not usually found on an average residential development scheme in the UK, the total cost of these product and market-specific measures (for prime residential) is approximately £70,000 per apartment, and accounts for 4.7 per cent of the average sale value of an apartment on this scheme (£1.5m). This amount doesn't take into consideration any uplifts for quality materials or other additional costs associated with prime properties (such as, for example, the provision of private lifts and separate staircases for staff).

If we review the use of the earlier described Poka Yoke devise – a template for cutting out electrical back boxes in plasterboard (Pollet and Ryall 2010) we find many large-scale examples of similar templates' application. For example, on a confidential luxury residential scheme in London, the contractor had to produce almost 140 number of templates (one for each bathroom) for cutting out holes for fixings and services in very large mirrors, which were located behind vanity units. These templates were made of plywood (following unsuccessful trials with cardboard) and their use included testing whether a particular, envisaged sheet of glass can be successfully transported into the bathroom for installation (the design intent called for one continuous sheet of glass with no intermediate joints to create a 'luxury' feel in the bathroom).

On every construction project, the design team is expected to identify mock-up and exemplary unit requirements early in the design process. There is usually a rigorous pre-contract and post-contract sample and mock up sign off process. An example of dashboard-formatted mock up requirements template is provided in Figure 1 below.

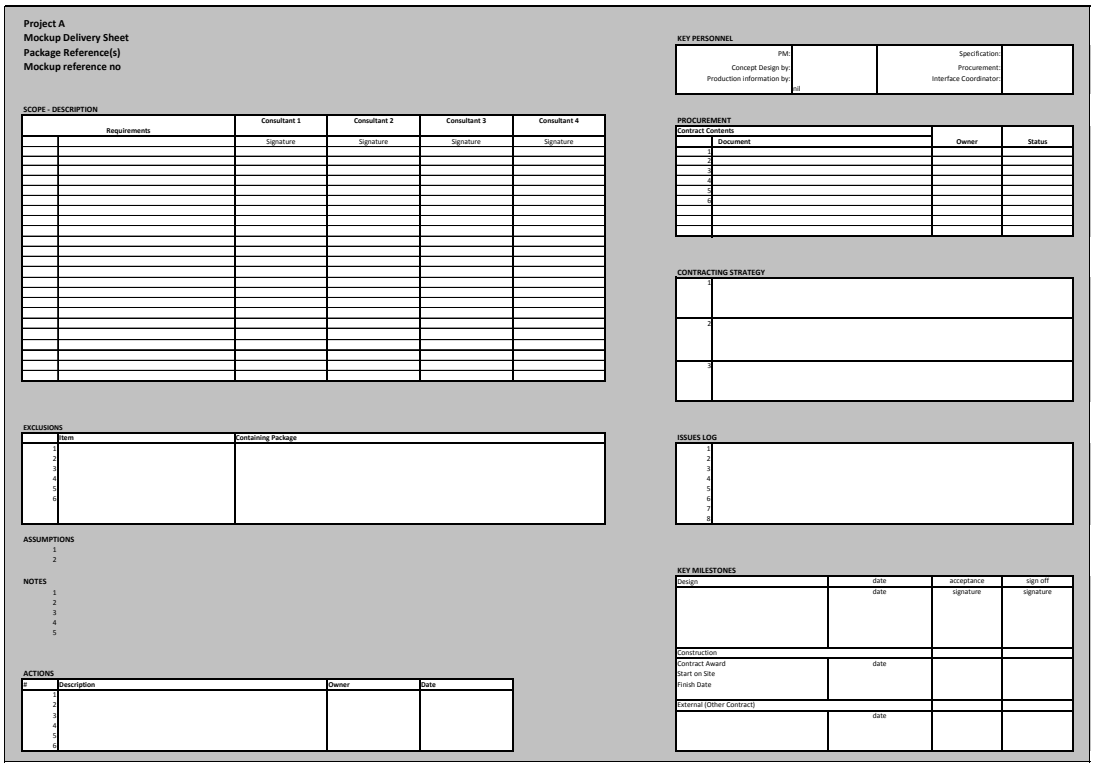

Figure 1 – Example of a mock-up requirement dashboard.

The accuracy of identifying, specifying, recording and tracking of samples and mock ups procurement and sign off processes is essential for the achievement of a 'zero defects' target and effective operation of these Poka Yoke devices.

CONCLUSIONS

Contrary to the prevailing image and reputation of the construction industry in the UK in the media and academic literature, the successful, continuous supply of quality products -- prized and trophy assets -- for high-net-worth individuals, Insurers, Private Equity, Institutional and Sovereign Wealth Funds suggests, that construction firms involved in their delivery developed robust processes which allow them to overcome the quality problems and achieve the required quality excellence. The applied performance-based quality management systems can be linked to the widely implemented, in the manufacturing industry, mistake proofing (Poka Yoke) concept and involve the extensive use of samples and mock ups.

Samples and mock-ups are used as the design development tool where the design functionality can be viewed and adjusted. In line with the findings of research in the field of quality failures in the construction industry, a great amount of workmanship quality failures can be attributable to people, design and construction. These mistakes can be avoided by the use of mistake-proofing devices such as samples and mock-ups. These measures permit identification of design mistakes, design scope gaps and to detect when the design team set the complexity bar too high, specifications does not highlight certain important issues to be observed by the contractor, the specification calls for a new material which contractor never came across before or an innovative way of materials' application which gave rise to unforeseen issues.

Samples and mock-ups are considered to be construction's best practice tool allowing the contractor to identify any buildability issues, identify opportunities for pre-fabrication, sequencing strategy, and to provide quality standard benchmark for subcontractors and suppliers to understand (and be measured against). However the considerable cost and programme implications of their deployment limit their application in the wider construction industry.

It is suggested in this research, that the extensive use of samples and mock ups is one of the most effective ways of managing quality in the construction industry and allows for less rework, fewer mistakes, fewer delays and better use of time and materials. The findings of this research create further opportunities for research on applications of Poka Yoke concept in the construction industry.

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PROBABILITY DISTRIBUTION FITTING OF COST OVERRUN PROFILES

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ABSTRACT

The statistical characteristics of cost overruns experienced from contract award in 276 Australian construction and engineering projects were analysed. The skewness and kurtosis values of the cost overruns are computed to determine if the empirical distribution of the data follows a Normal distribution. The empirical distributions for the cost overruns are found to be non-Gaussian. Theoretical probability distributions are fitted to the cost overrun data. The Kolmogorov-Smirnov, Anderson-Darling and Chi-Squared non-parametric tests are used to determine the 'Goodness of Fit' of the selected probability distributions. A 3-Parameter *Frechet* probability function is found to describe the behaviour of cost overruns and provide the best overall distribution fit. The *Frechet* distribution is then used to calculate the probability of a cost overrun being experienced.

Keywords: Australia, cost, Frechet distribution, probability density function, overrun,

INTRODUCTION

A cost overrun can be classified as a 'random continuous variable' as it can take an infinite range of values. Typically, the probability density function (PDF) of the Normal distribution (otherwise known as Gaussian) has been used to determine project cost overruns (e.g., Flyvbjerg, 2007). A Normal distribution is symmetric about its mean value and therefore cannot be used to accurately model left or right skewed data. Even if cost overrun data is symmetric by nature, it is possible that it is best described using heavy tailed distribution models such as a *Cauchy*. Fitting an empirical distribution to data can be a difficult task considering the array of statistical distribution choices that are available. The selection of an inappropriate statistical distribution can produce incorrect probabilities, which can adversely affect decision-making and therefore lead to negative outcomes. In addressing this shortcoming, this paper uses data derived from 276 completed Australian construction and engineering projects to determine the 'best fit' distribution so that a realistic probability of project cost overruns from contract award can be determined**.**

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COST OVERRUN

The term cost overrun is often referred to as 'budget increase', 'cost increase', or 'cost growth'. A cost overrun should, however, be distinguished from 'cost escalation', which is used to express an anticipated growth in a budgeted cost due to factors such as inflation. A lack of a standard definition juxtaposed with the inappropriate distributions models have contributed to inaccurate cost overrun probability forecasts being produced. Flyvbjerg et al. (2002) for example, defined a cost overrun as the difference between the forecasted and actual construction costs. In this instance, the budget at the decision to build is used as the reference for determining the overrun that may be incurred. Actual construction costs are defined as accounted construction costs at the time of completion. An alternative definition and reference point for determining a cost overrun have been provided by Zietoun and Oberlander (1993) who suggested that it is difference between the original contract value (i.e., contract award) and actual construction costs at practical completion. The dichotomy between definitions presented has contributed to significant variability in the cost overruns percentages that have been reported in the normative literature.

The Auditor General of Sweden (1994), for example, revealed that the average cost overrun for eight road projects was 86%, with a range from -2% to 182%. In contrast, Odeck and Skjeseth (1995) examined 12 toll projects and found the average cost overrun to be 5%, with a range of -10 to 170%. In a further study undertaken by Odeck (2004), a mean cost overrun of 7.9% and a range from -59% to 183% was reported for 420 road construction projects. For bridges and tunnels, Skamris and Flyvbjerg (1997) found the cost estimates from the decision to build to actual completion experienced a cost overrun of 50 to 100%. In a study of 258 transportation projects reported in Flyvbjerg et al. (2002), the following cost overruns were reported from the decision to build to actual completion:

- road construction (n=167), mean 20.4% with a range of 15% to 32%
- rail (n=58), mean 44.7% with a range of 24% to 60%
- bridges and tunnels (n=33), mean 33.8% with a range of -1% to 35%.

In contrast to the above findings, Vidalis and Najafi (2002) study of 708 road construction projects revealed a lower mean cost overrun of 10.52%. In building construction projects, for example, cost overruns have been reported to vary significantly for different project types. Ogunemi and Jaboro (2006) revealed the mean project cost overruns for residential were 40%, commercial 16%, and educational 28%. Similarly, Aibinu and Odeyinka (2006) found residential and commercial projects to experience mean cost overruns of 20.6% and 15.21%, respectively.

Issues relating to the project type and their influence on cost overruns have been examined and are subject to on-going debate. Flyvbjerg et al. (2002) revealed that there was a significant difference between the mean cost overruns for different project types but not for geographical location. Conversely, however, Odeck (2004) observed that project type did not influence the level of cost overrun incurred.

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RESEARCH APPROACH

The dataset presented in Love et al. (2009) for Australian construction and engineering projects is used to develop 'best fit' statistical distributions so that probabilities for cost overruns at contract award can be determined.

Questionnaire Survey

The questionnaire survey developed for the study reported in Love et al. (2009) was used to extract cost overrun information as well as that relating to rework costs and causes. Stratified random sampling was used to select the study sample from the telephone directory, Yellow Pages® for the various regions of Australia. Two main benefits can be derived from using a stratified sample: (1) It can ensure that adequate and representative respondents within each subgroup under study are acquired; (2) Stratification also ensures that respondents within the same group are homogeneous.

Before the sample size for the main study could be determined, a pilot survey was completed with 30 building and 20 civil engineering contractors. As the survey of building contractors was undertaken first, it was considered to be reliable, and then used to pilot the civil engineering sample. The firms sampled comprised of design and engineering consultants, project managers, and contractors. The rationale was to test the suitability, clarity, and comprehensibility of the questionnaire as well as measure the response rate. Participating firms were contacted by telephone and informed of the research aims and objectives and informed that all responses would remain strictly confidential; albeit, generalizations of the findings would be made available to all participants.

On participant consent, questionnaires were mailed to the sample, with a stamped addressed return envelope enclosed. Participants were invited to critically review the questionnaires' design and structure by annotating comments onto the document itself in order to provide constructive feedback. Comments received were positive and therefore the questionnaire remained largely unaltered for the main surveys; albeit a few minor layout changes were made to increase clarity. A total of 25 responses were received in the building project pilot survey, giving an 83% response rate. For the civil engineering project survey, a total of 17 responses were received, giving an 85% response rate. These high response rates were obtained because prior consent to support the work was obtained from all survey participants.

In the main survey, 420 and 300 questionnaires were distributed to design consultants, contractors and project managers for building and civil engineering projects, respectively. As there were no fundamental changes required to either of the pilot questionnaires, they were added to the samples. For the building and civil engineering projects, 161 and 115 responses were received respectively, which represents a total consolidated response rate of 41% for both surveys, which is within an acceptable range for a survey with industry practitioners.

PROCEDURE

Descriptive statistics such as the mean (M), standard deviation (SD), and inter-quartile were calculated. A one-way Analysis of Variance (ANOVA) was used to determine if cost overruns significantly varied between construction and engineering projects and original contract value at a 0.05 significance level. Probability density

functions were developed using *EastFit 5*. A PDF for a continuous distribution can be expressed in terms of an integral between two points:

$$\int_a^b f(x)dx = P(a \le X \le b) \qquad \text{[Eq.1]}$$

A cumulative distribution functions (CDF) was also produced. For theoretical continuous distributions the CDF is expressed as a curve and denoted by:

$$F(x) = \int_{-\infty}^{x} f(t)dt \qquad \text{[Eq.2]}$$

The empirical CDF, which is displayed as a stepped discontinuous line and dependent on the number of bins, is represented by:

$$F_n(x) = \frac{1}{n} \cdot [\text{Number of observations} \le x] \qquad \text{[Eq.3]}$$

The PDF, CDF and distribution parameters ($\alpha, \beta, \gamma, \mu, k, m, \sigma, \xi$) for continuous distributions such as *Beta*, *Burr*, *Cauchy*, *Error, Gumbel Max/Min*, *Johnson SB*, *Normal*, and *Wakeby* were examined using the estimation method of Maximum Likelihood Estimates (MLE). Using StatAssist 5.5, the 'best fit' distribution was then determined using the following 'Goodness of Fit' tests, which measure the compatibility of a random sample with a theoretical probability distribution:

- *Kolmogorov-Smirnov statistic (D)*: Based on the largest vertical difference between the theoretical and empirical CDF:

$$D = \max_{1 \le i \le n} \left(F(x_i) - \frac{i-1}{n}, \frac{i}{n} - F(x_i) \right) \qquad \text{[Eq.4]}$$

- *Anderson-Darling statistic (A^2)*: A general test to compare the fit of an observed CDF to an expected CDF. The test provides more weight to a distributions tails than the *Kolmogorov-Smirnov* test. The Anderson-Darling statistic is defined as:

$$A^2 = -n - \frac{1}{n} \sum_{i=1}^{n} (2i-1) \cdot \left[InF(x_i) + In\left(1 - F(x_{n-i+1})\right) \right] \qquad \text{[Eq.5]}$$

- *Chi-squared statistic* (χ^2): Determines if a sample comes from a population with a specific distribution. The Chi-squared statistic is defined as:

$$\chi^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i} \qquad \text{[Eq.6]}$$

where O_i is the observed frequency for bin *i*, and E_i is the expected frequency bin *i* calculated by:

$$E_i = F(x_2) - F(x_1) \quad \text{[Eq.7]}$$

Here F is the CDF of the probability distribution being tested, and x_1, x_2 the limits for the bin *i*.

The above 'Goodness of Fit' tests were used to test the null (H_o) and alternative hypotheses (H_1) that the datasets: H_0 - follow the specified distribution; and H_1 - do not follow the specified distribution. The hypothesis regarding the distributional form is rejected at the chosen significance level (α) if the statistic D, A^2, χ^2 is greater than the critical value. For the purposes of this research, a 0.05 significance level was used to evaluate the null hypothesis. The *p*-value, in contrast to fixed α values is calculated based on the test statistic and denotes the threshold value of significance level in the sense that H_o will be accepted for all values of α less than the *p*-value. Once the 'best fit' distribution was identified the probabilities for cost overruns were calculated using the CDF. Then, to simulate the samples randomness and derive cost overrun probabilities, a *Mersenne Twister*, which is pseudorandom number generating algorithm, was used to generate a sequence of numbers that approximated the sample to 1000 (Matsumoto and Nishimura, 1998).

RESULTS

Data from a total of 276 construction (n=161) and civil engineering (n=115) projects was obtained. In the case of construction projects, these ranged from banks to hospitals and hotels. For the civil engineering sample, these ranged from tunneling to road construction and sewer treatment plants. The summary statistics reveal that the mean OCV was A$23,142,486 (SD=A$41,171,772; minimum=A$132,347; maximum = A$390 million) and the mean Acv was A$25,455,372 (SD= A$45,090,928; minimum = A$136,671; maximum = A$420 million). The actual construction period was an average 4.7 years (SD=3.3 years), ranging from 3 months to 3.75 years.

To better understand the composition of the sample, an examination of respondent stratification, geographical dispersion, and company turnover was completed for the civil engineering sample. In terms of respondent stratification, 45% were design consultants (architects, quantity surveyors, and structural, mechanical, and electrical engineers), 31% were contractors, and 24% comprised project managers. With regards to geographical dispersion, organizations were situated across states: Victoria (45%), New South Wales (17%), Queensland (27%), South Australia (9%), and WA (2%). The analysis revealed that the average annual turnover of organizations sampled varied: < A$1m=14%; A$1 to A$10m =37%; A$11 to A$50m=20%; A$51 to A$250m=13%; and > A$250m=16%.

The mean overall project cost overrun for the sample was 12.22% (SD=20.65) of Ocv. Means were also determined for the two groupings of project types, construction and civil engineering, and were found to be 12.22% (SD=24.22%) and 11.76% (SD=13.76%) respectively. For construction projects the maximum cost overrun was 244% and a minimum -84% (i.e. cost under-run), which results in a range of 328%. For the civil engineering projects sampled the maximum cost overrun was 109% and a minimum of 11%, which results in a range of 98%. An ANOVA test

was used to determine whether there were significant differences between the cost overruns experienced in the construction and engineering projects (p = 0.05). The analysis revealed that there were no significant differences between the cost overruns experienced between construction and civil engineering projects [F (1, 274) =.611, p = 0.41]. Previous analysis of this dataset revealed that project cost overruns did not vary with procurement and tendering methods and project types (Love et al., 2009). Therefore, generic probabilities for determining the occurrence project cost overruns based upon the 'best fit' probability distribution were calculated.

Probability of Cost Overruns

The construction and engineering datasets were combined and the 'best fit' probability distribution was examined using the 'Goodness of Fit' tests: *Kolmogorov-Smirnov* and *Anderson-Darling.* The results of the 'Goodness of Fit' tests revealed that *Three Parameter (3P) Frechet* distribution provided the best fit for the dataset. The Kolmogorov-Smirnov test revealed a D-statistic of 0.2451 with a P-value of 0.99508 for the sample of 276 construction and engineering projects. The Anderson-Darling statistic A^2 was revealed to be 1.5357. The Chi-squared (χ^2) statistic was found to be 4.7451 with a P-value of 0.78444. The 'Goodness of Fit' tests all accepted the H_0 for the sample distribution's 'best fit'.

A Frechet is a form of generalized extreme value distribution (GEV) that is used as an approximation to model the maxima of long (finite) sequences of random variables. The parameter α is a continuous shape parameter $\alpha > 0, \beta > 0, \gamma$ is a continuous location parameter where $\gamma \equiv 0$ yields the two parameter-Frechet distribution. The domain for the 3P Frechet distribution is $\gamma < x < +\infty$. The PDF is expressed as:

$$f(x) = \frac{\alpha}{\beta}\left(\frac{\beta}{x-\gamma}\right)^{\alpha+1} \exp\left(-\left(\frac{\beta}{x-\gamma}\right)^{\alpha}\right) \qquad \text{[Eq.8]}$$

The CDF is expressed as:

$$f(x) = \exp\left(\left(-\frac{\beta}{x-\gamma}\right)^{\alpha}\right) \qquad \text{[Eq.9]}$$

The parameters for the *Frechet (3P)* were found to be α = 10.158, β = 90.215, γ = -84.29. The calculated probabilities of a cost overrun being experienced are presented in Table 1. The probability of experiencing a cost overrun of >10% is 47%. Delimiters have also been used to provide probabilities of cost overruns within ranges. The probability of a project experiencing between a 1% and 5% cost overrun, for example, is 16%. For a mean cost overrun of 12.22%, the likelihood that a project's exceed this amount is 60% (P (X < X1) = .60).

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Table 1. Cost overrun probabilities

Probability of a cost overrun between:	P(X1 < X < X2)	Probability	P(X < X1)	P(X > X1)
1 and 5%	0.16	5%	0.32	0.67
6 and 10%	0.2	10%	0.53	0.47
11 and 15%	0.16	15%	0.69	0.31
16 and 20%	0.11	20%	0.8	0.2
21 and 25%	0.07	25%	0.87	0.13
26 and 30%	0.05	30%	0.91	0.09

COST CONTINGENCY

A contingency can be defined as "the amount of funds, budget or time needed above the estimate to reduce the risk of overruns of project objectives to a level acceptable to the organization" (PMI, 2008). Most projects will experience cost increases between the decision to build and the contract award. A design contingency is typically allocated for changes during design for factors such as incomplete scope definition and estimating inaccuracy (Clark and Lorenzoni, 1985). As a project becomes more defined, the design contingency is absorbed into the budget for specific cost elements. Any unresolved design issues at the point of contract award should be incorporated into the construction contingency. At the initial budget stage a contingency of 30-50% should allowed for incomplete scope, and 5-10% for estimating inaccuracies (Clark and Lorenzoni, 1985). Thus, as a rule of thumb a 35-60% design contingency should be added to the initial budget estimate figure. Predicting the cost overrun from the decision to build to contract award relies exclusively on a large dataset so the empirical distribution of cost overruns can be used to determine the 'best fit' statistical distribution for probabilistic analysis.

A construction contingency is used for changes that may occur during the construction process. Under a traditional lump sum contract based on bills of quantities (BoQs), scope and design are supposed be fully defined and develop. As a result, Clark and Lorenzoni (1985) suggest a contingency value of 3-5% should be used. In practice complete drawings and BoQs are generally not available when a projects goes to tender. A similar situation arises when non-traditional methods are used to deliver projects. The analysis revealed that there was no statistical difference between the extent of cost overrun experienced and procurement method used. From the analysis presented above, it is suggested that a construction contingency value in excess of the average cost overrun of 12.22% should be used known unknowns (i.e. identifiable risks). For example, design errors and omission contained within contract documents have been found to contribute as much as 50% of a project's cost overrun (Love *et al*., 2009). From a client's perspective, design errors and omissions are identifiable risks and should be accommodated within a contingency. The probabilities derived from the statistical distributions provide the basis to monitor and reassess project costs. Identifying the key factors contributing cost overruns from contract award and assessing their likelihood of occurrence can enable clients and contractors to implement appropriate risk management strategies.

CONCLUSION

Using the contract award as a reference point, cost overruns from 276 construction and engineering projects were calculated. The research revealed that a mean cost overrun of 12.22%. No significant differences for cost overruns were found between procurement method, project type and contract size. The empirical distributions for the cost overruns were found to be non-Gaussian. Non-parametric 'Goodness of Fit' tests were used to select the best fit probability distribution. A *3-Parameter Frechet* probability function was found to provide the best overall distribution fit to calculate the probability of cost overruns. It is suggested that distribution fitting of empirical distributions is necessary to produce reliable and realistic cost overrun probabilities and as a result improve decision-making. Further research is required to determine if the probability distributions are applicable to wider populations.

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REDUCING THE COST OF POOR QUALITY THROUGH KNOWLEDGE MANAGEMENT

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ABSTRACT

The UK construction industry has been adversely affected by the current economic downturn, thereby creating a need to cut costs and improve efficiency, yet construction costs in the UK are higher when compared to other countries in the EU. A contributory factor to this high cost is poor quality in the project delivery process resulting in unnecessary expenditures of time, money, material and human resources and culminating into the 'cost of poor quality' (COPQ). COPQ has been linked to poor knowledge management (KM). While KM involves 'getting the right knowledge to the right people at the right time', the construction industry is recognised as being poor at learning, with organisations often 'reinventing the wheel', repeating mistakes and wasting knowledge resources. An on-going study from which this paper is developed therefore aims to investigate the impact of KM in reducing COPQ. Based on a thorough review of literature, the objectives are three-fold (i) to explore KM concepts and their applications within the construction industry (ii) to examine COPQ in construction (iii) to explore the impact of KM on COPQ. It is concluded that KM has neither been optimised nor fully exploited within construction management to reduce COPQ. The study contributes to efficiency improvement, quality improvement and cost reduction strategies within construction organisations.

Keywords: cost of poor quality, knowledge management, quality management.

INTRODUCTION

The construction sector is a major part of the UK economy. It represents some 7% of GDP or £110bn per annum of expenditure, some 40% of this being in the public sector, with central Government being the industry's biggest customer (ONS 2011). The industry has been affected adversely by the current economic crisis, therefore creating a huge need to reduce costs and improve efficiency. The Government's Plan for Growth Report (2011) particularly highlighted the critical importance of an efficient construction industry to the economy. Construction in the UK is relatively costly. The costs of infrastructure projects for example are excessively higher than in any other European country. Top-down analysis of benchmarks across sectors where comparative data are available, including high speed rail, roads, onshore wind and tunnelling all indicate higher relative outturn costs in the UK, ranging from a factor of 10% to over 100% difference. (Infrastructure Cost Review 2010). According to a

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global research by EC Harris (2011) UK construction costs remains one of the highest in the world. A contributory factor to the high cost is attributed to poor quality in the project delivery process resulting in unnecessary expenditures of time, money and resources, both human and material and culminating into what is known at the cost of poor quality or COPQ (Juran 1989, Feigenbaum 1991). Studies have been undertaken to quantify COPQ on various construction projects, the results of which have varied from one study to the other. Abdul-Rahman (1996) and Hwang (2009) for example found COPQ to be roughly 5% of the original contract value. Burati et al (1992) however found it to be as high as 12.4%.

COPQ has been linked to poor knowledge management (KM). According to O'Dell and Grayson (1997), KM is a conscious strategy of getting the right knowledge to the right people at the right time, and helping them to share and put the information into action in ways that improve their organisational performance. The construction industry however has been recognised as consistently being poor at learning. Organisations often reinvent the wheel, thereby repeating mistakes and wasting resources (Egan 1998, Grimaldi and Rippa 2011). Specialist and technical knowledge is lost from one project to the next stifling an organisation's ability to develop knowledge and generate new ideas (Egbu and Robinson 2005). While the link between KM and COPQ has been established, it is unclear what precise relationship exist between the two neither is there empirical evidence to suggest that the implementation of KM has been optimised within the construction management domain to reduce COPQ. This study therefore aims to investigate the impact of KM in reducing COPQ. Based on a thorough review of extensive literature of an on-going doctoral study, the objectives are three-fold (i) to explore KM concepts and their applications within the construction industry (ii) to examine COPQ in construction (iii) to explore the impact of KM on COPQ. The study contributes to the body of knowledge in the area of efficiency improvement, quality improvement and cost reduction strategies within construction management.

RESEARCH METHODOLOGY

The study is part of an ongoing doctoral study consisting of three phases namely: the critical review of literature; research methods; and research output. This paper focuses on aspects of the first phase and is therefore a theoretical study presenting critical discussions around KM and COPQ and their connection to practice. The output from the study contributes towards the first phase and the analysis, especially the conclusions in conjunction with other theoretical outputs move the research into stage two. As such the research is extensive in nature, leading to more intensive research at a subsequent stage and comparing and contrasting the findings with those from other conceptual and empirical work. The first phase is exploratory and accomplishes several purposes including gaining insight into previous work being done in the area whilst also filling the gaps and extending prior studies. Information sources utilised include printed journals, online gateways and databases, industry regulatory body publications, online journals, reference texts, conference papers and various books on the subject matters of KM and COPQ.

KM CONCEPTS AND APPLICATION

KM has been defined by several authors in several ways. Newell et al. (2009) defined it from a strategic perspective as '…improving the ways in which firms facing highly

turbulent environments can mobilise their knowledge base in order to ensure continuous innovation'. As a tool and technique, Bounfour (2003) defined it as a set of procedures, infrastructures, technical and managerial tools, designed towards creating, sharing and leveraging information and knowledge within and around organisation. The most common definitions of KM are those involving processes. Fischer (2001) for example, defined KM as a cyclic process involving, creation, integration and dissemination of knowledge. Skyrme (2002) presented the KM process as a continuous cyclic diagram showing how knowledge is identified, collected, classified, stored, shared, accessed, used, and new knowledge is created. It can be summarised from most definitions that KM involves some form of knowledge acquisition, exploitation and evaluation.

Two main types of knowledge that are widely recognised within academia and industry are: tacit knowledge and explicit knowledge (Nonaka and Takeuchi 1995, Nonaka and von Krogh 2009). Tacit knowledge is highly personal, developed from experience, and hard to formalise, therefore it is difficult to communicate. Explicit knowledge on the other and is formal and systematic. It is therefore easy to communicate and share. Much of the effort in KM has been focused on converting knowledge from one type to the other e.g. tacit to explicit utilising two approaches namely codification and personalisation. Codified knowledge is stored in an organisation's databases where it can be accessed and re-used. Personalised knowledge is closely tied to the person who developed it and is shared mainly through person-to person contacts as supported by an organisation's cultural environment. KM utilises a wide range of tools and techniques some of which are technology based (e.g. intranets, collaborative technologies) while others rely less on technology (e.g. communities of practice, story telling).

KM plays an important role within construction management in improving efficiency, increasing quality and reducing costs (Al-Ghassani et al. 2004, Anumba et al. 2005, Robinson et al. 2001). It is particularly important due to the arguably unique characteristics of construction projects such as the complicated nature of operations, multitude of occupations, professions and organisations, temporary team members and heavy reliance on experience, the one-off nature of the projects, tight schedules and limited budgets (Mohd Zin and Egbu 2010). The industry is also people-intensive, characterised by a wealth of experiential knowledge, yet staff retire or leave organisations regularly, taking a great deal of tacit knowledge with them (Suresh et al. 2008). There is therefore need to strategically manage employee-owned tacit knowledge within construction organisations (Carrillo and Chinowsky 2006) and need for knowledge integration across organisational boundaries (Ruan et al. 2012) leading to measurable outcomes such as retained knowledge, innovation, improved performance and client satisfaction (Armbrecht et al. 2001, Liebowitz 2002, Chua 2004, Boyd and Chinyio 2006).

Much effort has been made within academia to develop effective strategies for managing knowledge within construction organisations and on projects. The areas addressed include knowledge accumulation, knowledge capture, knowledge storing, knowledge sharing and knowledge transfer. In practice, an industry-wide KM effort, particularly in the UK where this study is focused, can be traced back to the Egan Report (1998). The report identified KM as means of driving efficiency improvements, and recommended strategies by which they could be achieved. These included execution of demonstration or innovative pilot projects across the country to showcase best practice so that knowledge can be transferred to other projects

(Olayinka and Smyth 2007, Smyth 2010). Demonstration project case studies were published and disseminated or diffused via a central knowledge base accessible to construction organisations. Best Practice Clubs were set up as avenues of personalised knowledge sharing among industry experts. Annual industry key performance indicators (KPIs) were generated based on data from thousands of projects completed each year and collated from surveys of construction clients, contractors, consultants and M&E Specialists for purpose of knowledge assessment and benchmarking (Constructing Excellence 2007). In spite of these KM initiatives the construction industry remains criticised for inefficiency, poor quality and high cost (Wolstenholme 2009). This brings about the question of what impact KM has made on the construction industry especially in reducing costs and improving quality.

COPQ IN CONSTRUCTION

COPQ can be defined as costs that would disappear if systems, processes, and products were perfect, in other words, these costs will be non-existence if there are no quality issues (Juran 1989). COPQ concept has found a variety of applications in several industries such as manufacturing and business. The study focuses on COPQ within the construction industry as it has become a major contributory factor to inefficiency and wastage leading to higher cost of construction. COPQ is a segment of Cost of Quality (COQ). COQ consists of the Cost of Good Quality (COGQ) and COPQ. While COGQ affects costs for investing in the prevention of non-conformance to requirements and for appraising a product or service for conformance to requirements, COPQ affects internal and external costs resulting from failure to meet requirements (Crosby 1979, Feigenbaum, 1991, Juran and Godfrey, 1998). Internal failure costs are those incurred when rectifying an error or defect before a product is handed over to the construction client. These include the cost of rework, cost of delays, cost of wastage and the cost of investigating non-conformances (Fayek et al. 2004, Love et al. 2004). Conversely, external failure costs are those incurred due to errors or defects in the product after it has been handed over to the client. Examples are the cost of handling client complaints, cost of repairing defects, legal and compensation costs among others.

Studies have been carried out on the causes of COPQ which include design changes, poor skills, errors and omissions occurring during the design, construction or handover stages of a project. While attempts have been made to quantify COPQ on various construction projects, results have varied from one study to the other. Burati et al (1992) investigated 9 major engineering projects to determine the cost associated with correcting deviations to meet specified requirements and found that it amounts to an average of 12.4% of the contract value. Abdul-Rahman (1995) found nonconformance costs excluding material wastage and head office overheads in a highway project to be 5% of original contract value. Love (2002) analysed data from 161 construction projects of various types and found that the mean direct and indirect rework costs were found to be 6.4 and 5.6% of the original contract value respectively, nevertheless, rework costs were found not to vary significantly with project type and procurement method used. Hwang (2009) using data obtained from a database of 359 construction projects assessed the impacts of different sources of rework on construction cost performance where the direct costs alone tallied to 5% of the total construction costs on many instances. COPQ has proven to be greater than the investment for managing quality (Juran and Gryna, 1988; Sorqvist, 1998),

therefore creating a need to investigate cost reduction strategies and identify potential cost savings.

IMPACT OF KM ON COPQ

Several initiatives have been adopted within organisations to improve quality and reduce cost. Quality management systems such as TQM, ISO9000 and Six Sigma have elaborated on the effects which a team-based improvement system can have on production. In conjunction with the systems, organisations have used quality management tools and techniques such as Benchmarking tools, Pareto charts, Cause and Effect diagrams, Kano analysis among many others. Despite these initiatives the construction industry is still recognised as being poor at learning on a consistent basis thereby repeating mistakes and therefore requiring a conscious strategy of getting the right knowledge to the right people at the right time, and helping people to share and put the information into action in ways that strive to improve the organisational performance. KM is therefore crucial in quality improvement and cost reduction strategies within construction management. It is important to identify KM and other components of COPQ in order to devise a strategy for its reduction. According to Juran and Godfrey (1998), two of the primary objectives of establishing COPQ are: to quantify the size of the quality problem; and to identify major opportunities for cost reductions. A major by-product of an evaluation of cost is the identification of costs of specific segments, each traceable to some specific cause. For example internal failure costs, constitute four segments: the cost of rework (e.g. cost of redesign, redoing construction processes, re-inspection); the cost of delays (e.g. cost of down time, shortages, change to non-conformances); the cost of wastage (e.g. inefficient use of plant, labour and materials); and other costs associated with investigation, and penalties for rework, delays and wastage.

There exist several causes of internal failure cost. According to Fayek et al. (2004), these can be grouped under five headings namely: 1) leadership issues (e.g. incompetent project leadership, poor communication); 2) human resource issues (e.g. insufficient skills, lack of personnel); 3) engineering review issues (e.g. late design changes, poor document control, errors and omissions); 4) planning and scheduling (e.g. space constraints, unrealistic scheduling); and 5) materials and equipment supply (e.g. non-conformance to specification, double handling). Since failure costs are indirect costs usually arising as a result of internal failure costs, external failure costs will disappear if there were no internal failure costs. The current study therefore focuses on internal failure costs which usually occur within the design and construction stages of the project life cycle before handover to the construction client or customer. Having identified internal failure costs and their traceable causes, the next step is to investigate the impact of KM processes on each cause. For example, what is the impact of knowledge codification on the project leadership issue of poor communication?' or 'what is the impact of knowledge access on the engineering review issue of late design changes?' The output from the investigation is an understanding of the current impact of KM on COPQ, identification of potential impact of KM on COPQ leading to the design of a KM model for reducing COPQ. .

CONCLUSIONS

A review of literature on the impact of KM in reducing COPQ has been reported in this paper as part of an on-going doctoral study. The review explored KM concepts

and their applications within the construction industry, examined COPQ within construction management, and explored the impact of KM in reducing COPQ. It was identified that construction cost in the UK is generally higher than in most countries within the EU. Part of the cost is attributed to poor quality in the project delivery process particularly the unnecessary effort in re-doing construction processes which culminates into the COPQ. However COPQ is avoidable and has proven to be greater than the investment for managing quality. COPQ has been linked to poor KM due to evidence that the construction industry is poor at learning, thereby repeating mistakes and 're-inventing the wheel'. The arguably unique nature of projects which are usually people-intensive and involving temporary team members and fragmented operations leads to significant knowledge loss from project to project. Retirement, redundancies and transfer of highly skilled personnel also lead to significant knowledge loss. Evidence suggests that KM has neither been optimised nor fully exploited within construction management. The impact of KM in reducing COPQ therefore involves the optimal management of employee-owned tacit knowledge and the strategy of getting the right knowledge to the right people at the right time in order to minimise rework, delays, wastage, and all associated costs. Measurable outcomes of KM optimisation include retained knowledge within an organisation, innovation through the creation of new knowledge, improved efficiency, improved quality of the processes, and personnel and end-products ultimately leading to reduction on costs. Empirical work on the impact of KM in reducing COPQ in construction will be presented in a subsequent paper.

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STANDARD FORMS OF ELEMENTAL COST ANALYSIS FOR CIVIL ENGINEERING

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ABSTRACT

Elemental classification differs from traditional trade based classification as it relates to parts of a construction Entity defined by their function without reference to their specification, design or construction, i.e. what they do rather than how they are built. The application of elemental classification for buildings to cost planning, cost management, cost analysis and cost benchmarking is standard in the UK and common in other countries. It has allowed the construction cost professional to provide elemental cost models from the earliest stages of a project and the design team to design to a cost rather than costing a design. The use of elemental classifications and their application to cost modelling is not common practice in civil engineering. An elemental data structure for civil engineering was developed by BCIS for the UK Defence Infrastructure Organisation and has been proposed for wider application; in the US ASTM Uniformat have also proposed elemental classification for civil engineering entities. The principles and applications of elemental classification are discussed and progress on developing standards in the UK and USA is reported.

Key words: Civil engineering, Cost analysis, Classification, Elements, Entities.

INTRODUCTION

This paper reports on current work being undertaken by the Building Cost Information Service (BCIS) of the Royal Institution of Chartered Surveyors (RICS) to produce a standard elemental structure for use in capturing and reporting cost information on Civil Engineering projects. The initial research and proposals were reported in detail to a previous COBRA conference (Martin 2010). This paper reports on the proposed Standard Form of Civil Engineering Cost Analysis (SFCECA) data structure that was published in November 2011 and the issues raised by the consultation with client bodies and the relationship to similar work in the USA being carried out by ASTM Uniformat II committees. This is a report on ongoing work and the tables and definitions set out in this paper are therefore liable to change. We would welcome comments and suggestions

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Background

The purpose of an Elemental cost analysis is to provide data that allows comparisons to be made between the costs of achieving various functions in a project, with those of achieving equivalent functions in other projects, so that information from existing projects can inform the budgeting and benchmarking of future projects.

The use of Elements and Elemental cost analyses is a well-established practice for buildings where the BCIS Elemental Standard Form of Cost Analysis (BCIS 2012) provides the rules for consistent analysis. This cost information is used for early cost advice, cost planning and cost benchmarking, while the Elemental classification is also used for client briefing, performance specifications, value engineering and life cycle costing[2].

No such common standard form of cost analysis exists for civil engineering. This makes benchmarking of civil engineering difficult and, where it is possible, a costly exercise. The purpose of this current work is to propose rules for analysing civil engineering projects into Entities and Elements.

Initial Research

BCIS undertook to develop a cost data structure for the UK Defence Infrastructure Organisation (DIO) to analyse the costs of their civil engineering projects in a consistent manner that would facilitate benchmarking and the provision of data for early cost advice. The DIO manages the Ministry of Defence's property infrastructure and ensures strategic management of the Defence estate as a whole. It has responsibility for most MOD expenditure on infrastructure management and delivery activities.

The initial phase was desk research to establish what classification system existed for civil engineering structures. The classification systems that offered something that looked like 'Entities' and 'Elements' as defined for our purpose were Uniclass (CPIC 1997) Omniclass (OCCS) and some unpublished proposal for specific Entities from the American Society for Testing and Materials (ASTM).

Both Uniclass and Omniclass are structured in a similar way to ISO 12006-2 Building Construction - Framework for classification of information.

The BCIS proposed structure was based on defining a standard list of 'Entities' and lists of 'Elements' for each Entity.

DATA STRUCTURE AND PRINCIPLES OF ANALYSIS

Entities

'Construction Entity' is listed as a table in ISO 12006-2, where it is defined as:

> *Construction entity:* Independent material construction result of significant scale serving at least one user activity or function. Examples building, bridge, road, dam, tower, sewer, museum (if a single structure), sports field, sewage settlement tank'.

The ISO recommends the use of two classification tables for Construction entities 'Entities by Form' and 'Entities by Function or user activity'.

[2] BCIS, *Principles of elemental classification for buildings (International),* provides a general introduction to elemental classification and its uses.

In Uniclass, which predated the ISO, the table for 'user activity/purpose' is called 'Facilities'. The Entity table uses the following definition:

> *Construction Entity* is an independent construction of significant scale. This table classifies construction entities according to their physical form/basic function. Examples include buildings, bridges, roads, dams, towers, retaining walls, pipelines, etc.

The concept that we require is structures defined by what they do, i.e. their object function. However, in trying to define the individual entities it was found necessary to refer also to physical form, e.g. quay as a 'vertical face with contiguous horizontal, usable surface for loading/unloading'. We have therefore used the Uniclass definition:

> *Entity* is 'an independent construction of significant scale defined by its physical form/basic function, e.g. Pavements, Pipelines, Buildings.'

We have expanded on the, rather sketchy, table in Uniclass and a list of entities defined in the Standard Form of Civil Engineering Cost Analysis – Outline Data Structure is attached is given in Table 1.

Table 1 BCIS and ASTM Entity structures

BCIS SFCECA	*ASTM UNIFORMAT II*
Pavements and landscaping	Transportation surfaces
Railways	Bridges
Platforms, quays, jetties and the like	Waterfront
Retaining structures	Dam and Canal
Dividing structures	Pipelines
Containers	Water and Sewerage
Support structures	Underground – Tunnel
Pipelines and ducts	Storage Tanks
Open conduits	Communications
Cables	Power
Wells	Manufacturing and Processing
Ground contouring	
Bridges	
Tunnels	
Ornamental structures	
Miscellaneous/unclassified projects	

Entity Types

Each entity will have a range of 'Entity Types' that define their user function, e.g. 'Pavements' may be used for runways, taxiways as well as various types of road, etc. It is proposed that the entity types will be defined based on Uniclass Table D – Facilities, where possible.

Elements

We have used the BCIS SFCA definition of an element:

> Element is a major physical part of an entity that fulfils a specific function, or functions, irrespective of its design, specification or construction.

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BCIS STANDARD FORM OF CIVIL ENGINEERING COST ANALYSIS

For each Entity BCIS proposed a single set of elements with generic definitions, but these may need to be separately defined for different Entity Types. For example, roads and runways have the same element 'communications' but highway signalling is different, and is described differently, from air guidance lighting.

Example: The proposed Elements for the Entity 'Pavements' are:

Pavements

1 Substructure
- **1A** Subgrade

2 Pavement
- **2A** Preparation (for resurfacing)
- **2B** Pavement structure
- **2C** Pavement surface
- **2E** Edge treatment

3 Pavement completion
- **3A** Drainage
- **3B** Electrical power installation
- **3C** Lighting installation
- **3D** Heating installation
- **3E** Water installation
- **3F** Communications
- **3G** Protection and security
- **3H** Special installation
- **3I** Ancillary (structures and equipment)
- **3J** BWIC

Costs that are not attributable to the physical parts of the building should be analysed in to:

- Preliminaries
- Main contractor's overheads and profit
- Contingencies and risks
- Contractors design fees on design and build contracts.

For benchmarking rules are required for allocating the non-elemental costs to ensure consistence of the data.

Analysing a project

A project (i.e. a contract that is being analysed) may be made up of one or more Entities together with External Works and Facilitating works.
Broadly speaking 'Facilitating works' are things that are required before the entity can be constructed and 'External works' are things that are included to complete the contract in addition to entities analysed.

Ancillary information required

The context in which an Entity is built is probably the biggest factor in determining its cost. Therefore it is essential that the cost information is accompanied by information to put the costs of a project in its context. This should include, for example, details of site conditions, such as ground conditions, access, water table, tidal range, etc.

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Elements for Specific Entities
Elements have been defined for each Entity. The published proposals provide the following information for Elements for each Entity.

- Definition: setting out a broad description of the element.
- Functional definition: describing what the element is intended to do.
- Measurement rules, suggested measurements that will help to define the scope of the works and aid in interpreting the costs. Where more than one measurement is given, the first is the Element Unit Quantity for that element.
- Design criteria: suggested design criteria that will help to define the scope of the works and aid in interpreting the costs.
- Includes/Excludes: illustrative list of items included in each element and list of exclusions cross referenced to another element to augment and clarify the definition.

An outline data structure has been proposed for all Entities and detailed definitions proposed for:

- Pavements
- Airfield Pavements
- Quays, Piers, Jetties, Platforms and the like
- Support structures (Masts, Towers and the like

ASTM UNIFORMAT II CLASSIFICATION OF HEAVY (CIVIL) ENTITIES

ASTM International, formerly known as the American Society for Testing and Materials publish an Elemental classification for building called Uniformat II. They also publish an outline for preparing Element classification for a range of Entities. A list of ASTM Entities is given in Table 1.

They have recently published, through the US Department of Commerce National Institute of Standards and Technology (NIST), a proposed UNIFORMAT II Classification of Bridge Elements (Kasi and Chapman 2011), and are working on element classifications for Dam and Canal, Waterfront, Highway Transportation and Road Tunnels.
The interest in this endeavour is the same as that of BCIS, i.e. the need for consistent analysis of costs for benchmarking and early cost advice.

BCIS is corresponding with ASTM and, while there are some differences in detail, the element structures that are emerging on both sides of the Atlantic are similar enough to suggest that analysing civil engineering projects into entities and elements will provide the useful benchmark data required by funders and clients.

UK GOVERNMENT DEMAND FOR CIVIL ENGINEERING BENCHMARKING

In 2010, Infrastructure UK, part of HM Treasury, published a Cost Review a report of an investigation into how to reduce the costs of delivery of civil engineering works for major infrastructure projects. The report identified a number of drivers for the higher cost of construction in the UK compared to other EU countries and supports the view

that higher costs for UK infrastructure are mainly generated in the early project formulation and pre-construction phases.

The cost international comparisons made in the report highlighted the lack of standard cost data reporting. However, it also concludes that if minimising outturn cost were considered at every stage of a project by all participants then projects would be cheaper. IUK found a tendency, particularly in the public sector, to concentrate on building within client's budget rather than aiming at lowest cost for the required performance. This has lead to a general Government strategy to implement cost lead procurement and the need for benchmark data. IUK has set up a data and benchmarking task group to work with departments to provide benchmarks.

The Ministry of Defence benchmarks are being developed around the data collected by BCIS for Defence Infrastructure Organisation using the SFCECA classification.

BCIS analysed six runway resurfacing schemes. It indicated a significant difference between schemes which included some new work in extending the runway as well as resurfacing. While the sample size is small, it does provide a benchmark figure of £68/m2 of pavement for resurfacing schemes and £250/m2 of pavement for the extension and resurfacing schemes (Costs at 2q2011, UK mean location).

The SFCECA for Airfield Pavements defines both the measurement of the Pavement area and the costs to be included in the benchmark.

CONSULTATION WITH CLIENT ORGANISATIONS

In discussions with client organisations, it has become clear that any standard structure needs to be agreed sector by sector with the major clients. Most clients have some level of cost reporting requirement on their projects and need to be convinced that a standard approach across their sector, and with other sectors where appropriate, will warrant their changing their requirements.

For example in the UK there are two major clients for railway work, Network Rail (NR) and London Underground (LU). Table 2 shows a comparison of their cost breakdown structure for track.

Table 2 London Underground and Network Rail cost structures for Rail track works.

LU Cost Feedback Structure		**NR Analysis of Costs**	
100	Trackwork	**1.01**	Permanent way
		1.03	Level crossings
200	Buildings		
300	Power supply	**1.05**	Electrification Contact systems
		1.06	Electric power and plant
400-405	Bridges	**1.08**	Civil engineering works (05 Bridges and viaducts)
406-408	Retaining structures (cuttings, embankments, retaining walls)	**1.08**	Civil engineering works (02 Earthworks, 06 Retaining walls)
409-410	Drainage	**1.08**	Civil engineering works (02 Earthworks, 08 General drainage)
412	Dividing structures	**1.08**	Civil engineering works (07 Fencing and enclosures)
414-415	Tunnels	**1.08**	Civil engineering works (0.4 Tunnelling)
500	Signalling	**1.02**	Signalling equipment and systems
600	Communication	**1.04**	Telecommunications

We have now proposed a revised structure for the SFCECA for railways which could present costs from both the London Underground and Network Rail structures. See Table 3.

Table 3 Possible SFCECA for Railways

Entity Railway

Trackwork
Level Crossings
Power supply
Electrification
Signalling
Communication

Other Entities

Pipelines (Drainage)
Dividing structures (fences and walls)
Bridges
Retaining structures (cuttings, embankments, retaining walls)
Tunnels
Buildings

CONCLUSION

The key to identifying standard elements for civil engineering structures is identifying entities with a definable object function.

Disaggregating the object functions of these entities identifies the elements.

BCIS has proposed a set of entities that will cover most projects and is developing elements for them.

It has become clear that for some entities, elements need to be defined differently for different entity types.

Some data has been collected on behalf of a client and the proposed data structures have already proved useful in providing benchmarks for future cost.

Similar proposals are being made by standards organisations in USA.

The advantages of having cost information available that relates to the functions of an entity are the ability to provide early cost advice and set robust budgets before design commences, to design to a cost rather than cost a design. However, it remains to be seen if consistent data collection of elemental cost information of civil engineering entities will be as useful as it has been over the past 50 years for buildings.

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ACADEMIC INTEGRITY; ACHIEVING BEST PRACTICE IN BUILT ENVIRONMENT DEGREE PROGRAMS

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ABSTRACT

Educational institutions globally are grappling with the rising incidence of academic misconduct, in part fuelled by the ever increasing access to online information. Recent audits of universities in Australia (AUQA 2009) indicated that students believed that their institutions did not have the necessary strategies in place to dispel students' perceptions that plagiarism may be tolerated. This paper reports on the development of teaching tools within Built Environment degree programmes at the University of Queensland. The objective of an online tutorial tool was to improve students' understanding of academic integrity and good academic practice and to do so in a supportive teaching and learning environment, through the development of an online interactive tutorial. The aims of the tutorial were to: develop learners' skills in knowing when to reference information and thus avoid plagiarising in their academic work; provide accurate information in an interesting, relevant and interactive way; ensure relevance to the institution's diverse student body; incorporate the ability to assess students' understanding of good academic practice; and ensure that the tool would be accessible as a learning resource for students throughout their programs of study. Through pre and post implementation surveys the changes in student perceptions of good practice were identified and used to refine the tutorial tool. Finally the paper reports on the adoption of the teaching tool on a university wide basis and its compulsory application to over 20,000 students.

Keywords; Academic Integrity, Australia, On-line education, Plagiarism

INTRODUCTION

Plagiarism and poor academic practice are a fact of life. It is not disputed that students both inadvertently and deliberately plagiarise (Curtis et al. 2011; James et al. 2002; Park 2003; Sutherland-Smith 2008). This culture of plagiarism is then frequently carried forward into the workplace and professional life (Roberts 2008). These findings have particular relevance in programs that prepare students to enter into fields of professional practice, which uphold high levels of ethical practice. This paper investigates issues of academic integrity within the property and real estate degree courses in Australia and in particular the steps taken at The University of Queensland

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(UQ) to address the perceived increase in the incidence of poor academic conduct among both undergraduate and graduate students. Universities offer a wide range of educational programs, many of which are vocational, leading graduates into careers which invariably require membership of professional institutions. Many of these courses seek accreditation of their programs by professional bodies in order to ensure that students can seek to attain membership after graduating. The property and real estate professions including the Australian Property Institute (API) and the Royal Institution of Chartered Surveyors (RICS) are among those which accredit many of the programs in Australia including those offered at UQ. Each of these professional bodies seeks to maintain high ethical standards among its members and each publishes a code of ethics by which members are required to abide (API 2008; RICS 2008). These ethical codes require that members 'practise their vocation with integrity, honour and professionalism' (API 2008). The relationship between student ethics and those in the profession has been highlighted on a number of occasions (Hefferan et al. 2010; Oladokun 2012; Wilkinson et al. 2008). In a recent UK study of property employers seeking to employ graduates, the key attributes were found to be professional practice and ethical standards (Poon et al. 2011).

Academic integrity and good practice are central to student learning and to professional life after graduation. The ability to apply critical reasoning to issues through independent thought and informed judgement are key attributes that universities seek to instil in their students, however poor ethical judgement is certainly not an attribute which should be reinforced by acceptance in education. Academic misconduct is a problem that seems to be on the rise in most countries (Carroll, Jude 2004; Carroll, J et al. 2001; Larkham et al. 2002; Park 2004; Roberts 2008). The Australian Universities Teaching Committee (AUTC 2008) indicated that while it is impossible to determine trends in the incidence of plagiarism in higher education institutions, it appears to be widespread, and occurs across a range of disciplines (Peterson et al., 2009a,b). Studies by McCabe and Trevino (1996) reported on a longitudinal study of university students in the USA which showed a marked increase in the reported occurrence of plagiarism over the 20 year study period. A staggering 54% reported copying material without proper citation and 26% deliberately plagiarised the work of others.

The apparent prevalence of plagiarism and the perception that the level of poor conduct is rising have been attributed to a number of factors including: the availability of on-line information and the resultant ease with which students can 'cut and paste' information from numerous web sources; the ability to easily download academic papers for free or at a small cost together with dedicated sources which actively sell assignments on a range of subjects (Evans 2000; Thompson et al. 2002); time pressures students face in meeting assignment deadlines; the use of group work to reduce faculty time pressures and large classes may lead to an increase in students' plagiarism of each other's work; reduced access to staff; and increased reliance on past student work (James, McInnis & Devlin, 2008).

The incidence of plagiarism and the perception among students that poor academic practice and plagiarism are tolerated in universities has been an issue raised by the Australian Universities Quality Agency (AUQA) in a number of its audits of Australian Universities. In an audit of UQ the agency observed that: 'The University also needs to address a concern held by students in some schools that plagiarism or copying is tolerated, a matter that AUQA recommends be addressed in the University's forthcoming review of its policy on plagiarism' (AUQA 2009). It is

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recognised that a contributing factor to student perceptions of university tolerance of plagiarism can be attributed to a lack of clear understanding among students as to what constitutes plagiarism. Many cases of alleged misconduct can be attributed to misunderstanding and ignorance among students about why they should avoid plagiarism and how they can do so (AUTC, 2008).

This paper describes the steps taken to reduce poor academic conduct within the property and real estate programs at UQ. Many universities have developed policies and procedures to deal with plagiarism. These are largely punitive measures that address the consequences of poor practices resulting in loss of grades or a fail grade for the course. A more pedagogically sound approach is based on a proactive intervention which raises awareness and knowledge of good academic practices, and provides the necessary tools to avoid unintentional poor practice allowing students to demonstrate academic integrity. Our research indicates a significant improvement in the level of students understanding of academic integrity and resultant reduction in the incidence of reported cases of plagiarism following completion of the student intervention.

DEVELOPING A RESPONSE

Prior to the AUQA Audit in 2009 the incidence of poor academic conduct had been recognised within students undertaking property and real estate degrees at UQ. A major contributor to the identification of this problem was the widespread adoption of plagiarism detection software within a number of courses. Tools such as TurnItIn automated the detection of poor academic writing, collusion and of blatant plagiarism. Like many institutions the response to this increasing awareness of poor academic practice was the development of an enhanced School Protocol for dealing with individual cases of plagiarism with clear guidelines for escalation of disciplinary action based on the level of seriousness of the act of cheating. In reviewing individual cases of poor academic practice it became readily apparent that in many cases students were not deliberately seeking to cheat but rather, were inadvertently falling foul of plagiarism detection efforts due to poor or inadequate understanding of good academic writing practices. It was also apparent that there was some considerable variation among students in their understanding of good academic practise based on their education to date, with many overseas trained students in particular, appearing to have a much less developed understanding of the process of academic writing within Australian universities.

In order to address the lack of understanding among students a training module was developed. The rationale behind development of this tool was to ensure that all students entering the property programs would be required to undertake a training tutorial and to record a minimum pass mark to demonstrate understanding of the concepts. On completion of the training module all students should have a sound understanding of good academic practices and as a consequence any detected misconduct after completion of the module could more readily be attributed as a deliberate attempt to gain advantage rather than be blamed on a lack of understanding.

A comprehensive online training module was developed over a two year period with assistance from professional programmers and experts in instructional design. The intent was to create a user friendly format which engaged students in various online exercises aimed at developing their understanding of issues of copyright, academic referencing, collaboration and collusion in preparing academic assignments (Peterson et al. 2009, 2010). The module provided for interactive engagement, with students

using a number of response tools from simple radio buttons or yes/no responses through to requiring input of full bibliographic references in either Harvard or Chicago styles. Each section of the tutorial responses was evaluated and students were unable to proceed until an adequate score was attained. The student's final score was recorded as a record of completion of the tutorial. The module was initially implemented as a pilot in selected first year courses. Following a number of software design enhancements the module was implemented for all students within the School of Geography Planning and Architecture and for students entering the Business School program in property and real estate development (Peterson, Neil, et al. 2009).

EVALUATION OF INTERVENTION OUTCOMES

In order to evaluate the development of the training module a number of student surveys were developed and administered in order to gain an understanding of student attitudes and knowledge of good academic practice. Initial surveys of students focus on the early stages of developing the online tutorial tool and have been previously reported in (Warren et al. 2012). These early surveys of students were conducted both before and after the educational intervention with the objective of investigating any change in student understanding and attitudes toward plagiarism and poor academic practice. The questionnaires were administered online and provided an anonymous vehicle by which to obtain frank and honest feedback from a large cohort of students in their first semester at university. The survey was distributed to a group of 447 students initially with follow up surveys sent to 260 students who completed the tutorial.

Analysis of the initial survey data provided a basis on which to start to understand the main issues relating to good academic practice and was used to develop the online tutorial response. All first year students entering the program were required to undertake the tutorial and were later invited to participate in a post-evaluation survey. These post tutorial surveys clearly show that students' understanding of what constitutes plagiarism had significantly changed (Warren et al. 2012).

The success of the training tutorial as both a tool for enhanced student learning and as a means of ensuring that all students are aware of the Universities' policy on plagiarism has been recognised. This along with the attention brought to the issue by the AUQA audit of the university led to further refinement of the teaching tool and its introduction on a university wide basis. From 2012 all students commencing study at UQ are required to undertake the online-tutorial. With a total student cohort of around 20,000 students this represents a significant increase in the number of students undertaking the training module and has afforded the opportunity to develop a greater understanding of student attitudes across the whole university. As part of the implementation of the tutorial all students are invited to participate in an online survey prior to commencing the tutorial.

The results of this wider survey conducted in semester one 2012 will be used in conjunction with a follow up evaluation to be conducted at the commencement of semester two with the objective of identifying any changes in student understanding. Once again the completion of the training module will enable teaching staff to more clearly differentiate blatant plagiarism, as the students will no longer be able to claim they did not understand that what they were doing was wrong.

The university wide pre-tutorial survey was undertaken by a total of 1343 students with just 109 Students opting not to participate in the evaluation survey. The results

of this survey reveal a significant lack of understanding among students of what constitutes poor academic practice. Using the same survey format adopted for the earlier surveys and reported in Warren et al. (2012), the larger survey bears out those earlier results. The survey instrument used Likert scale questions to gauge student attitudes to a number of issues related to plagiarism and poor academic practice. The survey adopted a five point scale ranging from strongly agree to strongly disagree together with a "don't know' option. Analysing the survey results and combining those agreeing or strongly agreeing with what constitutes plagiarism, only 83% of students thought paraphrasing or summarising others' work without citation was plagiarism Table 1. This result alone shows that there is a serious issue to be addressed.

Conversely, directly quoting others' work and correctly citing the source was still seen as plagiarism by 20% of students once again demonstrating a lack of understanding. It has long been understood that while many students recognise that copying text is plagiarism they frequently fail to recognise that copying images is also plagiarism. The survey showed that copying a diagram or table and citing the source was still thought to be plagiarism by 21%, while only 73% understood that this was acceptable practice, with the remainder unable to decide.

Although in a related question, while plagiarism was thought to be a serious issue in academic writing with 97% of respondents agreeing that it was a serious matter only 70% thought that copying images and maps from the internet was serious. It thus seems that students apply a different standard to images than written text. Students were particularly unsure when it came to taking a paragraph of text and altering several words. Only 50% thought this was wrong, while 35% believed this to be acceptable practice.

Table 1 Student Responses: Plagiarism Includes:

	Agree	Neutral	Disagrees
Paraphrasing or summarising someone else's work and not citing them as the source.	83%	5%	12%
Quoting information in your essay and correctly citing the source.	20%	5%	75%
Working with a group to produce a final report and claiming you contributed equally when you did less work than the other members of the group.	50%	19%	24%
Submitting an assignment for assessment that you have previously submitted for another course.	54%	15%	26%
Inserting an image, map or diagram into your assignment and correctly citing the source.	21%	5%	73%
Not citing the original source when you use someone else's idea, but you express it completely in your own words.	63%	16%	18%
Creating an informal study group to brainstorm your assignment topic	18%	14%	64%
Observing a design and incorporating the key ideas into your design and acknowledging the designer.	21%	10%	66%
Copying a paragraph and replacing several words so it's not exactly the same as the original, and citing the source of the information.	50%	12%	34%
Copying and pasting information from the Internet and incorporating it into an assessment item without acknowledgement.	83%	4%	13%
Copying information from several sources due to the demands of the course and other time constraints.	75%	10%	11%

The results of this survey reinforce the need for students to be given specific guidance in good academic practice. This is particularly so when 61% of respondents acknowledged that they had never received any formal training in academic integrity and plagiarism. With this finding it is little wonder that many students fall into bad habits and unwittingly plagiarise in their academic writing. The need for training in good academic practice is further reinforced when nearly 12% of students consider cheating to be part of the real world and that 25% think that copying is a way to speed up assignment preparation.

CONCLUSIONS

The incidence of cheating and poor academic conduct among university students has been increasing in recent years. The increase in cases of plagiarism is variously attributed to the ease which material can be copied from web sources through to the increasing time pressures placed on students. Recognition of this growing problem among students studying to enter professions where honesty and integrity are fundamental values required in professional practice is of concern to both the academic community and to the broader profession. The results of a study among students seeking to enter the property professions has demonstrated a lack of clear understanding as to what constitutes good academic practice. This finding matches the observation among academics that much of the plagiarism detected in students' academic writing is a result of poor understanding or practice rather than a deliberate attempt to deceive. The educational intervention developed as part of the property and real estate programs at UQ has been successful in raising student awareness of the issues related to poor academic practice. However, as the results show there is still a need to increase student skills further in the use of proper citation. This research has validated the development of the teaching tool and led to its adoption on a university wide basis in 2012. Subsequent data from a university wide survey has validated the earlier findings that students lack a clear understanding of what constitutes poor academic practice. Most students recognise that plagiarism is a serious issue, yet many of them are unable to recognise what is or is not plagiarism in all but the simplest of incidences.

There is a need for much more in-depth research into the reasons for poor academic practice among students and in particular further evaluation of the benefits of a program such as that implemented in our courses. Further analysis across a more diverse group of students and subject disciplines is currently underway and will be evaluated against the increasing use of plagiarism detection software which is increasingly becoming a compulsory element in university assignment evaluation.

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ASSESSMENTS FOR QUANTITY SURVEYING COURSES

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ABSTRACT

A series of assessment schemes working from first principles to incorporate the appropriate objectives, competencies and outcomes. The need for contemporaneous feedback is incorporated into the various schemes. Using self and peer assessment is shown to be time saving, accurate and popular. The problems of failure and plagiarism are reviewed. A more rigorous system using minimum standards rather than percentages is demonstrated.

Key words : Criteria, definitions, minimum standards, percentages, principles.

INTRODUCTION

This paper examines assessment from first principles, proposes suitable criteria for assessing quantity surveying (QS) work and then provides practical examples. It is a further contribution towards a synoptic pedagogy for QS.

PRINCIPLES AND DEFINITIONS

The principles of teaching technical competencies like QS and their assessment have been elaborated in Ostrowski (2010, 2011) and are summarized below.

Table 1 Principles for a synoptic pedagogy for QS technical competencies.

EPISTEMOLOGICAL	COGNITIVE	PSYCHOLOGICAL	ENVIRONMENTAL	EMOTIONAL	TEACHING
Procedural Knowledge	Knowledge	Behaviourism	Facilities	Personal	Training
Contingent Instruction	Understanding	Cognitive Psychology	Collaboration	Motivation	Outcomes
Contemporaneous Feedback	Learning	Constructivism	Groups	Risk Free	Assessments

CRITERIA

Formative and summative assessments

*"…**formative assessment** is that undertaking the assessment constitutes a learning experience in its own right...**summative assessment** is not traditionally regarded as having any intrinsic learning value." www.heacademy.ac.uk 24.7.08.* It is often the case in technical competencies like measurement for assessments to be exercises for submission at the end of term. Although nominally a formative assessment, because they appear to demonstrate the progressive acquisition of knowledge, they are in fact a summative assessment because they do not provide any opportunity for feedback. To be formative assessments the feedback, which consists of marking the work and providing annotations on the scripts, needs to be

available before the next piece of coursework is undertaken, i.e. contemporaneous feedback. Summative assessments rely on a demonstration of the extent of the acquisition of technical competence and are normally closed book examinations with no feedback.

Criterion referenced and norm referenced assessments

Criterion Referenced Assessments (CRA) is marking to a standard. A judgement is made about performance. Norm Referenced Assessments (NRA) is competitive marking. They make comparative judgements about people. Technical competencies are an arbitrary positivist paradigm (Cohen, Mannion and Morrison, 2007) and there is either a right or a wrong answer. The objective is an active, authentic demonstration of capability, not talking or writing about it. The analogy is trying to use a written examination to establish the technical expertise of a bricklayer. What is required is a practical test of competence. Biggs (2003) describes it as the extent to which functional knowledge can be "…*put to work*…" (p. 206). The assessment is convergent, solving problems that have a particular unique answer. To reach an appropriate level to be able to demonstrate that the right answer has been achieved is a CRA of professional competence. NRM is not appropriate where the objective is a particular standard that has to be achieved.

Multiple choice tests

The attraction of multiple choice tests (MCT) is the speed of the process which reduces the marking burden of large classess. However there is a fundamental problem with using MCT. Technical competencies are a particular kind of knowledge, procedural knowledge and this requires a particular kind of teaching and a particular kind of assessment. This is aligned teaching. Biggs (2009) states *" Use an assessment task that directly addresses the outcome and enables you to directly judge if and how well the student's performance meets the criteria."* Shavelson, Ruiz-Primo & Wiley (2005, p.415) provides the direction " *And to measure procedural knowledge, performance assessments, not paper and pencil, are necessary."*

To emphasise the importance of ensuring that the right kind of test is provided Biggs (1996) is insistent that MCT is inappropriate. The following series of quotations leaves little room for doubt. *"However when the modes of assessment go no deeper than acquaintance, as is likely with MCT..."* (p. 46) and *"students saw MCT as requiring low cognitive level processes; indeed using deep approaches was negatively related to MCT test performance."* (pps.172-3) and *"MCT assesses declarative* (propositional) *knowledge, usually in terms of the least demanding process, recognition. MCT reflects the extent of (declarative) knowledge.* (p.180)

There are examples of MCT that have been devised for technical competencies that try to overcome this. For example the test is set up in the normal MCT manner but the answer can only be provided when the student has completed a calculation on a separate document. This means that the answer needs marking using the MCT format but also the calculation needs collecting and marking also. The additional marking reduces the advantage of using MCT and still does not provide an adequate assessment of the acquisition of the technical competence. The dangers of using inappropriate assessment procedures is pointed out by Gjestland, Blanton & Lerouge (2004, p.18) who state that "*The results indicate a significant difference in the performance of students between the questions testing declarative knowledge and those testing procedural knowledge* (Abstract) and *"...there is a significant difference in the performance of the students between declarative and*

procedural questions... those students with more experience...performed better at the procedural questions...".

MCTs are designed for a different kind of knowledge, cannot demonstrate the acquisition of procedural knowledge and cannot be adapted to do so.

Failure

The price of increased class sizes, reduced thresholds, increased diversity with little increase in teaching staff who are able to provide technical competencies is an increased failure rate. This failure rate, euphemistically called the retention rate, has also become the target for penalties to try to ensure that the most marginal of the students are retained in the system. This is a particular problem with technical competencies where there is a right and wrong answer with few marks available for interpretation and context.

Peelo and Wareham have reviewed failing students and have stated *"...this tension between the widest possible access to universities & the need to maintain standards has been with us for years..."* (2002, p.4). They have indicated that between 1992-1998 the rate of non-completions was 17-19%. The reasons for this are given as poor quality of experience, inability to cope with course demands, unhappy with social environment, wrong course, finance, dissatisfaction with some part. The *'inability to cope with course demands'* is likely to include academic ability and the time demands of students who also have to work or care for a family. They have used the phrase non-completions rather than failure or retention and they take the view that progression includes a significant amount of adjustment *"...For many failing is not an event but a series of hesitations..."* (2002, p.3) and *"... in educational terms, failing can be part of a developmental process and a means of learning..."* (2002, p.3). Work in South Africa on foundation years for disadvantaged students has indicated that the range of problems encountered required a high level of resources and personal attention. This comes mainly from the perceived inequalities of a substantial minority whose diverse backgrounds require individual attention. (Grayson, 1996 & 1997 and Miabila, Maladje & Addo-Bedialo, 2006).

Peelo and Wareham make a strong plea not to consider a low retention rate, i.e. a high failure rate, to be an indication of fault or failure. They state *" ...the key to dealing with failure in HE is to accept it as a normal and desirable part of the learning experience....Failure itself is unlikely to harm...a constructive acceptance of it is highly desirable..."* (2002, pg 123).

The solution is to reduce the standard or the application of a large amount of resources to achieve lower failure rates. The former is unacceptable and the latter impossible. An appropriate response might be that the increased failure rate is a natural consequence of increased diversity and numbers.

Bonuses

Hertzberg (1959) and Maslow (1970) identified significant motivating factors as achievement and recognition. Positive and negative motivation have been developed by McGregor (1960). Positive motivation is a reward for success, achievement and recognition is provided in the form of marks and bonuses. Negative motivation is just as important in a positivistic paradigm such as measurement where failure is recognised as incomplete and inaccurate work. For technical competencies negative motivation is an important educational tool. For high achievers a bonus mark for exceptional contribution is a useful positive

motivator. For low achievers the negative motivator of fear of failure is also effective. The public recognition of achievement is a proven positive motivator and the apparent suppression of published lists of results by the Data Protection Act (1998) is a retrograde step.

Minimum Standards

Another criterion for assessment is the need to set out and maintain a minimum standard that is acceptable. Perera, Pearson and Ekundayo (2011) have pointed out that there is no standard way to interpret the actual achievement of competencies. The use of minimum standards addresses this difficulty. The problem with percentages and Pass/Merit/Distinction as performance indicators is that undue emphasis can be given to the 'soft' options of managerial and moral competencies. A pass can be obtained despite a poor performance on the technical competencies because a large proportion of the marks are provided for other competencies. The pass rate or retention level, can also be increased by reducing the tariff for a pass. A pass rate of 35% is not unusual and a substantial proportion of this can be in non-technical competencies. Borderline cases at 25-35% are often favourably reviewed with an eye on a large tail of failures that is looming. This is the inevitable consequence of large and diverse student numbers and limited teaching resources. The result is that standards are compromised and the results are diluted to the point that students pass through the system and emerge with little technical competence. The system has been prejudiced and its value is questioned. It may not be possible to maintain technical competencies standards in the light of the relentless pressure on resources.

One solution has been described by Bouriscot and Roberts (2006, pgs 74-96) using a more rigorous approach. A performance based method of establishing if technical competencies have been acquired is described whereby medical students who are practicing various components of expertise do a circuit of 'stations' "*…and perform a particular task at each…"* A panel of experts *"…describe a minimally competent/borderline student to establish a level of competence for the particular examination…"* at each station. This removes the ubiquitous percentage system of marking and imposes a practical appraisal of technical expertise. Minimum standards is part of a marking scheme currently in use at London South Bank University (LSBU) by Helen Ward for assessing minimum clinical technical competence of nurses. It is described by Ward and Barratt (2009, p.5) who have provided a practical scheme for assessing the minimum clinical (technical) competence of nurses at LSBU using assessment stations of 10 minutes each. *"…final year 10-station OSCE session which comprises three physical examination stations (technical competence); three history taking stations; three stations that cover communication skills (managerial competencies)…"* Conversation with Helen Ward indicate that these schemes have been in place for 20 years. They are a benchmark for the whole industry for both the assessment process and the content.

The use of minimum standards at particular 'stations' for the assessment of QS technical competences provides a standard that will reassure the profession and students. Teachers will have to teach to this standard which is a more rigorous appraisal rather than to a sliding scale of percentages. The marking burden is also much reduced.

Plagiarism

Copy and paste is now the normal method of preparing work. If information is extensively and freely available restricting its use becomes counterproductive to

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education and training. Plagiarism/copy and paste has a limited value in enhancing the knowledge of those participating in it. To provide specific guidance the emphasis should change from restriction to encouragement. For example indicate that the level of personal work should be 75%. This would limit plagiarism/cut & paste to 25% without providing a restrictive covenant. Bonus marks for no plagiarism/cut & paste would be a positive motivation for cognitive development. To date electronic surveillance, eg Turnitin, is not effective for technical competencies.

PRACTICAL APPLICATION AND EXAMPLES

The following table provides a comprehensive marking regime:-

Outcomes as percentages

The objectives are set out as percentages. They are the primary functions of technical, managerial and moral competencies. The key functions are the specific outcomes for that discipline. The proportions that are assigned emphasise the need to acquire technical competence. Failure to reach the necessary level of technical competence is a powerful negative motivator for low achievers. A bonus is a powerful positive motivator for high achievers.

Self and peer assessments

The group exercises carried out and marked by the students in collaborative groups in class, which encourages participation and provides empowerment. Self and peer marking is characterised by the self-marking students awarding marks according to the effort involved. The peers mark the quality of the work. The marking is best administered by asking the peers to mark the work first. This allows the self-markers to see a relatively objective assessment before they mark their own work. The emphasis changes from marking the effort to marking the quality. The work should be moderated by the examiner to indicate the gap between the marks provided by the students and that of the teacher. The marks of the students and the teachers will become closer with practice. My own experience is that this takes one academic year.

Formative Assessments

The courseworks are undertaken outside the classroom and are marked by the lecturers. Formative assessments help the acquisition of technical competencies and allows students to develop insights into their strengths and weaknesses. They have a primary objective of performance and comprise progressive problem solving coursework exercises. The annotation of the submissions and marking sheet is provided within 10 days on the Gradebook on Blackboard and provides the contemporaneous feedback which Biggs (2003) emphasises as probably the most important factor of all in assessments.

Summative Assessments

The principles of using both formative and summative assessments allows the growth of practice to be checked during the term and then tested and graded at the end. The summative assessment has a clear objective of demonstrating functioning knowledge and a suitable assessment task is problem solving. Closed book examinations demonstrate the extent of the acquisition of technical competence. The summative assessment of a formal three hour closed-book examination of solving problems that have a unique answer remains a challenge for some of the students. There remains a significant failure rate that is usually repeated at the

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resits and this is because the realisation that shallow learning will not succeed in these technical competencies has not been achieved. Moderation of coursework and examination marking by other members of staff and external examiners ameliorates variable quality. These criteria are demonstrated on an assessment marking sheet below.

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Table 2 Prescriptive marking using percentages

ASSESSMENT CRITERIA OBJECTIVES & OUTCOMES				**FORMATIVE**							**SUMMATIVE**	**UNIT MARK**
				Group Exercises					Coursework		Examination	
				20%					40%		40%	
				Self & Peer Assessment					External		External Assessment	
TECHNICAL COMPETENCE				Levels	CL	Grid	Formwork	Pergola	RC Frame	BQ	Closed book	
ACCURACY		35%										
	Side casts		10%									
	Accurate dimensions		10%									
	Checks		5%									
	NRM		5%									
	References		5%									
COMPREHENSIVE		35%										
	All trades		10%									
	All items in each element		10%									
	Rulings		5%									
	Drawing interpretation		5%									
	Checks		5%									
MANAGERIAL COMPETENCE		10%										
	Presentation/Mark up drawings		5%									
	Queries & T/O list		5%									
COGNITIVE DEVELOPMENT		10%										
	Problem solving		5%									
	Responsibility/leadership		5%									
BONUS		10%										
	Outstanding contribution		10%									
		100%	100%									
	Weighting			4%	4%	4%	4%	4%	20%	20%	40%	
Assessor's Comments												

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Minimum standards

This assessment programme provides an opportunity to demonstrate to all the stakeholders that the teaching has achieved a suitable minimum standard. The following table provides a recent example of a minimum standards assessment marking sheet for a technical question. The equivalent percentage mark is also shown. Many of the border line successes using the percentage method did not in fact meet the minimum standards because they were unable to demonstrate accuracy or comprehensiveness in some of the fundamental areas. Overall the percentage failure using percentages was 14%. Using minimum standards the percentage failure was 31%. This can provide a benchmark for students, staff, employers and professional institutions for acquisition of the necessary technical competencies at progressively higher levels.

Table 3 Minimum standards: working example

CONCLUSIONS

Despite the frailties of the various forms of assessments they are necessary to demonstrate levels of technical competencies. The development of an effective assessment scheme is part of a synoptic pedagogy for QS teaching. The requirements of teaching a complex technical subject based mainly on procedural knowledge are extensive. The same is the case for the assessment process. The pressure of increased numbers and limited resources provide an opportunity for innovative assessment systems that improve the standards and reduce the burden of marking. The prescriptive marking scheme provide an alternative which reduce the marking load, improve quality, removes bias and empowers students. The minimum standards system ensures a transparent threshold for students, staff and employers.

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BINDER LEACHING OF NATURALLY HYDRAULIC LIME MORTARS

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ABSTRACT

Masonry built in lime mortar is one of the principle building materials used in traditional construction. This form of construction can convey the appearance of strength and stability and could be argued to epitomise built homogeneity. This may however not reflect reality due to deterioration of the wall core resulting in an alteration in the effective thickness. Predicted future climate change models for northern regions, indicate more instances of heavy rainfall. This will undoubtedly result in materials used in mass masonry structures becoming saturated for extended periods, increasing instances of binder migration (binder leaching). The leaching process involves the deterioration of binder structure via dissolution and removal of calcium into the pore fluid. This can, in many cases, result in reprecipitation of calcium on the external skin of the structure. The effect of this phenomenon on the physical properties and performance of lime mortar has not yet been fully investigated but early stage results indicate a reduction in mechanical strength and an alteration of the materials moisture handling characteristics. The current EPSRC funded research project (EP/G064865/1) aims to ascertain the extent of binder leaching by inducing an artificially accelerated leaching environment. Leaching trials have been carried out on a variety of natural hydraulic limes (NHL), both carbonated and uncarbonated, representing those potentially found on mass masonry structures. The present work aids our collective understanding of this fundamental deterioration process enabling prediction of mortar condition and performance to be achieved. Determining traditional building resilience has never been as important, especially given the broader context of climate change.

Keywords: binder, dissolution, leaching, lime, mortar

INTRODUCTION

An estimated 446,000 pre 1919 dwellings, totalling 20% of the building stock, exist in Scotland today. The vast majority of these are believed (McKinney, 2007, Urquhart, 2006) to be constructed of stone. More specifically, it has been estimated that there are some 24,000 traditional built stone facades in Glasgow alone, requiring approx £500M to repair (Urquhart, 2006). Of course, structures constructed in traditional mass masonry are not restricted to Scotland or to tenement forms, with innumerable

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low rise domestic buildings, historic bridges, viaducts, infrastructural masonry (i.e. retaining walls), castles and palaces existing within the UK and across the world. Mass masonry construction is generally composed of an internal and external skin of masonry bedded in lime mortar with a lime built rubble core. The structural performance of these walls relies upon the effective thickness and homogeneity to create stability.

Anecdotal evidence from building professionals is that situations have arisen in which the mortars have been found to be binder deficient (Forster, 2007). In many situations, voids have been found in wall cores behind the apparently sound masonry pointing and bedding mortar, and this has been subsequently associated with progressive collapse in many traditional buildings (Kent, 2005). Beckman, (1995:86) indicates that '*if the skins are thin compared to their height and if they are not well connected to the core, they may buckle*'. It is therefore clear that the condition of the core is critical for stability.

McKibbins *et al* (2006:78) believes that '*Contributory mechanisms for deterioration of masonry in all types of structures include, moisture saturation and leaching of mortar…. Leaching results in physical loss of strength and adhesion. Mortar that has undergone severe leaching can become weak and friable, and is easily lost from joints by washing-out or compressive extrusion in areas of high stress, resulting in local stress concentrations and loosening masonry units.*' Beckman (1995:86) reinforces this view highlighting the implications of long term saturation, indicating '*rainwater enters the core and dissolves or leaches out the lime and loosens the fine particles. These are then washed down, leaving behind cavities, which grow until the rubble collapses into them*'. Binder leaching is clearly a function of moisture content and it is evident that due to increased rainfall associated with climate change (Hume, 2002; Cassar & Hawkins, 2007) masonry fabric will be wetter, for longer. Certain components within the mortar may dissolve and move from the body of the material and be re-deposited within the pores, construction voids, or may be left simply upon the wall faces of the building (see plate 1).

Plate 1: Lime leachate to piers

The most vulnerable binder components to dissolution are (Hewlett, 1998, Taylor, 1990) calcium hydroxide ($Ca(OH_2)$ and calcite (calcium carbonate, $CaCO_3$). The hydraulicity of the original mortars will have a significant influence upon the set characteristics of the material. Non-hydraulic and feebly hydraulic limes require a high degree of carbonation for their set propagation and have a correspondingly low

proportion of hydraulic components within their composition. Intuitively, these forms of lime binders are the most susceptible to dissolution, when placed in saturated, cold conditions and is a function of the relative proportion of $Ca(OH)_2$.

The extent to which binder dissolution occurs has yet to be fully undertaken. It is however, assumed that the rate of deterioration will be extremely slow and may take decades rather than years. Although these time frames may be very slow, it must be emphasised that many of the structures that we are dealing with may already be many decades old, and those that are considered historic in nature may be centuries old. Those buildings that are ruinous may have been roofless for several hundred years, further exacerbating the problem. This Engineering & Physical Science Research Council (EPSRC) funded project (EP/G064865/1) has undertaken to evaluate this phenomenon and this work establishes some of the preliminary findings.

RESEARCH OBJECTIVES

The aim of the research is to establish the rate and consequence of soluble binder leaching from various lime mortar types commonly used in traditional mass masonry construction. It determines the effect on physical and chemical properties of the mortars, and specifically the work investigates the changes to the macro and micro pore structure and its effect on moisture transfer mechanisms. The project objectives are:

1) Determine the rate of free lime binder leaching ($Ca(OH)_2$) in a range of hydraulic lime mortars, using ammonium nitrate accelerated deterioration method.
2) Assess the changes in moisture handling characteristics of the samples via sorptivity testing.
3) Assess the effect of binder loss upon the compressive and flexural strength characteristics of the lime mortars.
4) Characterise the change in the composition of the mortars.
5) Develop a predictive model for assessing the influence of binder depletion on compressive and flexural strength of the mortars to give building professionals and engineers a rational basis for of in-service performance prediction.

EXPERIMENTAL PROCEDURE

Sample manufacture and curing

A range of lime binders adopting a constant binder to aggregate ratio for all samples of 1:3 (by weight) was used. This regime was a modification of BS EN 459-2 (2010) and BS EN 1015 (2002). Well graded silicaceous sand (Cloddach concrete sand) ensured isolation of variables as it does not contain calcinitic mineral components. This aggregate is representative of materials commonly used for the repair of traditional masonry structures in Scotland. St Astier natural hydraulic lime (NHL) was used as it is the most commonly adopted binder for conservation works in the UK. NHL2 (feebly hydraulic), NHL3.5 (moderately hydraulic) and NHL5 (eminently hydraulic) samples were manufactured and cast into 160 x 40 x 40mm prisms moulds, following BS 459:2 (2010). These samples were cured in a TAS series 3 environmental cabinet under two different regimes in order to modify the physical and chemical characteristics of the mortar; one ensured a full carbonation set (60% RH at 20°C) whilst the other un-carbonated (100% RH at 20°C). This was an attempt to simulate conditions that may be encountered in existing structures, namely, fully carbonated mortars located in the outer masonry and partially carbonated or

uncarbonated material within the wall cores and inner sections of bridge construction. The carbonation regime followed that established by Lawrence (2006).

Accelerated leaching

A chemical extraction process using ammonium nitrate (NH_4NO_3) was utilised to accelerate the leaching of calcium (Ca^{2+}) ions from the NHL samples. Nguyen *et al*, (2007) formerly used this technique to evaluate deterioration in cements and concretes and indicated an accelerated leaching of Ca^{2+} ions in the region of 200-300 times that that of the natural phenomena. Modification of Nguyen *et al*, (2007), experimental procedure was undertaken to take account of the different characteristics of naturally hydraulic lime mortar compared to the relatively more durable concretes and ordinary Portland cements. This resulted in a dilution of the ammonium nitrate concentration reducing the solutions aggressivity. Samples were immersed in a solution of 1 mol/l (1M) concentration of ammonium nitrate in deionised water. The volume of the solution was kept constant and monitoring of the pH and temperature was continuously logged via a data acquisition system (see fig. 1).

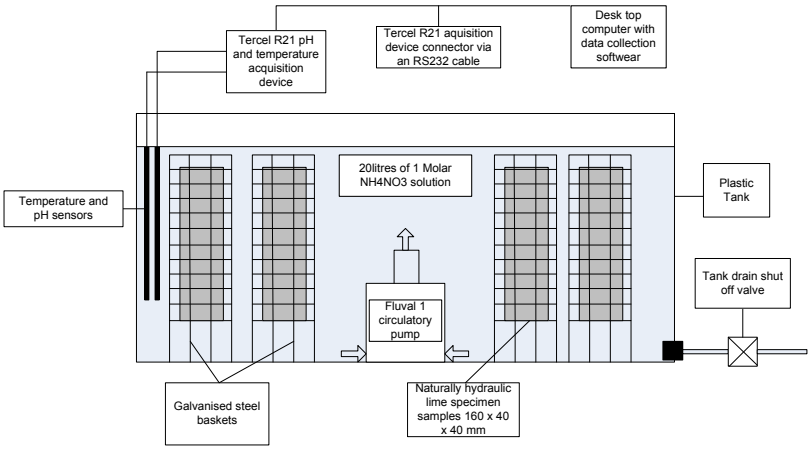

Fig 1: Ammonium nitrate extraction apparatus (after Nguyen, 2007)

A pump ensured that the ammonium nitrate solution was circulating, thereby preventing non uniform solution concentration. The samples were immersed for 1, 4, 9, 16, 25, 36, 100 and 169 days. Additional samples were ran in parallel for the initial 36 days. These were kept in vats of de-ionised water in an attempt to establish a datum for the natural dissolution rate.

Physical and chemical investigation of pre and post accelerated samples

A range of tests were established to determine the physical and chemical characteristics of the materials. Control samples were used to provide a baseline for pre deteriorated properties. Samples that had been subjected to accelerated deterioration were tested at various intervals (as previously outlined) adopting the following techniques:

i) Phenolphthalein testing: In order to measure the speed of dissolution the samples that were subject to the ammonium nitrate and deionised water were fractured and surfaces were sprayed with phenolphthalein solution. This was undertaken to measure, and ultimately calculate the leaching depth of the $Ca(OH)_2$ from the samples (see plate 2). **ii) Sorptivity testing:** The sorptivity of the mortar samples were evaluated using the '*sharp front theory*' established by Hall & Hoff, (2002:97). The sorptivity of each prism sample type was determined by immersing the bottom surface

of the samples in water and measuring weight gain / over-time following the basic function $t^{1/2}$ (see fig.4). This gave an indication of the change in pore structure and subsequently the moisture transfer characteristics. **iii) Flexural and compressive strength:** Each sample type was tested in a Lloyds universal testing machine (model M5K) at specific intervals. This enabled an assessment of the influence of loss of $Ca(OH)_2$ on the physical characteristics of the mortar samples. **iv) Petrograhic analysis:** A selected range of mortar samples were assessed under polarised light microscopy, enabling the pore structure and mineral composition of the binder to be determined by point counting. This was undertaken to identify the influence of leaching of $Ca(OH)_2$ and to evaluate the remaining components, such as calcite and calcium silicate hydrates (C-S-H). **v) ESEM analysis and EDAX:** The freshly fractured surfaces were studied adopting the Philips XL30 ESEM, whilst simultaneously undertaking Energy Dispersive X-Ray Micro-analysis (EDAX) techniques to determine the chemical composition of the products of hydration of the binders used, and the surface characteristics of the material.

Preliminary results and discussion

Provisional experimental results for the ammonium nitrate (NH_4NO_3) extraction tests will be discussed. It must be emphasised that the project is still ongoing and these results simply establish early stage findings of the physical properties, and more specifically the compressive, flexural and sorptivity values. The results focus on the NHL5 and NHL2, carbonated and un-carbonated mortar samples as they are representative of the extremes in material composition and more specifically the relative quantity of calcium hydroxide ($Ca(OH)_2$) and calcite ($CaCO_3$) if carbonated.

Compressive and flexural results

The test results indicate a clear difference between the samples subjected to the NH_4NO_3 and the de-ionised water (see fig 2 & 3). The samples generally correlate with perceived wisdom, in so much as, the samples with a higher proportion of hydraulic set and therefore a reduced carbonation requirement (such as an NHL5 samples) have a smaller decline in strength.

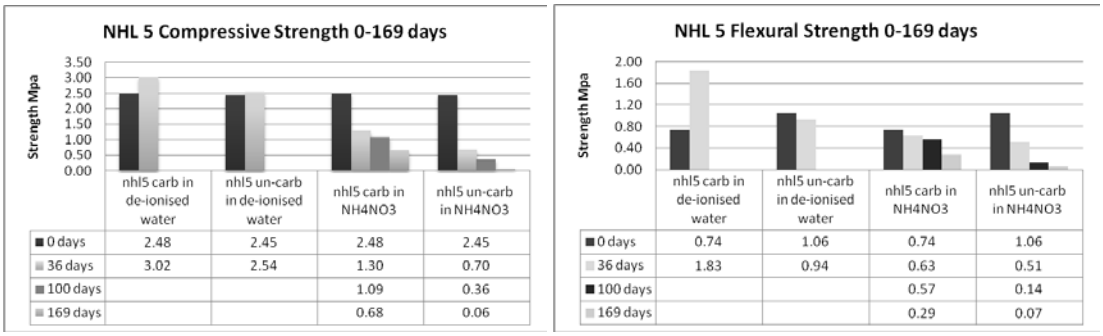

Fig. 2. Compressive and flexural strength changes over time NHL5

The NHL5 carbonated samples in the de-ionised water increased in compressive and flexural strength over the 36 day period while the un-carbonated samples showed an increase in compressive strength and a marginal decline in their flexural strength (See fig. 2). This may be associated with favourable hydration curing environment (i.e. submerged in water). The NHL5 samples in the NH_4NO_3, both carbonated and un-carbonated samples exhibited a large decrease in their compressive and flexural strength over the same time frame, with compressive strength being more effected.

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After this initial 36 day period the NHL5 carbonated samples did not exhibit a large decline in compressive and flexural strength (100 and 169 day testing period). In comparison the un-carbonated sample continued to decline in strength, with the result that there was negligible strength left at the 169 day period (See fig. 2).

The NHL2 samples in comparison to the NHL5 reflect a different pattern. All the NHL2 samples decreased in both compressive and flexural strength when subjected to the de-ionised water and the NH_4NO_3. The small loss of strength in the carbonated NHL2 relative to the NHL5 samples subjected to the NH_4NO_3 could potentially be attributed to the high proportion of calcite formation. Conversely, the slow hydration of belite (C_2S) [the main hydraulic component in hydraulic limes] and its subsequent conversion into C-S-H in the NHL5 samples would make the carbonation formation disproportionately important in terms of strength development. The un-carbonated NHL2 samples in the NH_4NO_3 had insignificant strength left after the initial 36 day period (See fig. 3). This would generally be associated with higher proportions of $Ca(OH)_2$ and calcite leaching from the samples.

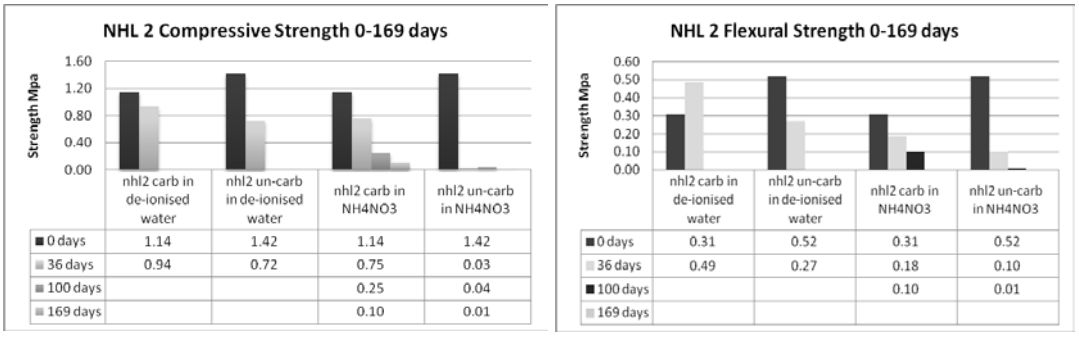

Fig. 3. Compressive and flexural strength changes over time NHL2

Sorptivity: The sorptivity values for the un-carbonated samples were lower than the carbonated ones. This was unexpected with the NHL5 carbonated samples attaining the highest values of all. The NHL5 samples, subjected to the de-ionised water exhibited the highest reductions in their sorptivity values (see fig 4). The carbonated NHL5 also exhibited a reduction after 36 days in the NH_4NO_3 whereas the un-carbonated samples increased. (See fig.4)

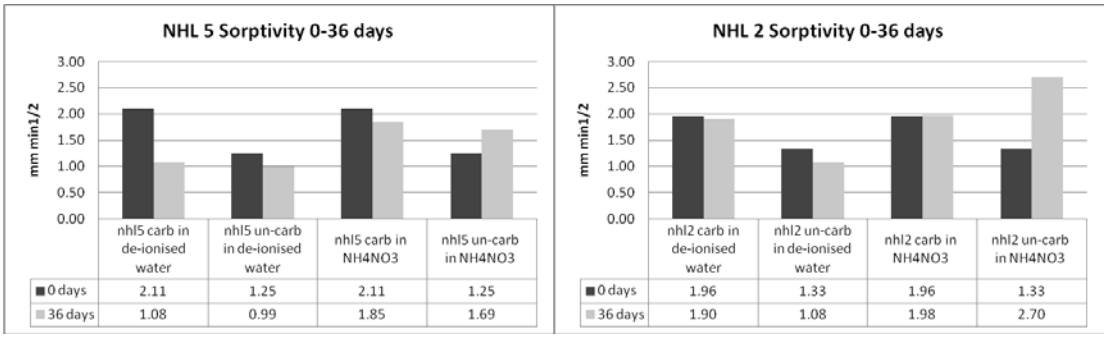

Fig. 4. Change in sorptivity value of NHL2 and NHL5

The carbonated NHL2 sorptivity values were not greatly affected over the course of the 36 days test runs, whereas the un-carbonated NHL2 samples reduced significantly in strength and exhibited a 50% increase in their sorptivity value. This is indicative of

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washout of the $Ca(OH)_2$ and is visually represented in the phenolphthalein staining test results seen in plate 2.

Dissolution front assessment (phenolphthalein staining): It was observed during the first experimental run that all the un-carbonated [$Ca(OH)_2$] lime material had leached out within the first 36 days. As such it was not possible to track this dissolution front. Attempts to ascertain the extent to which the NH_4NO_3 accelerates the process and subsequently effects the materials physical and chemical properties were undertaken.

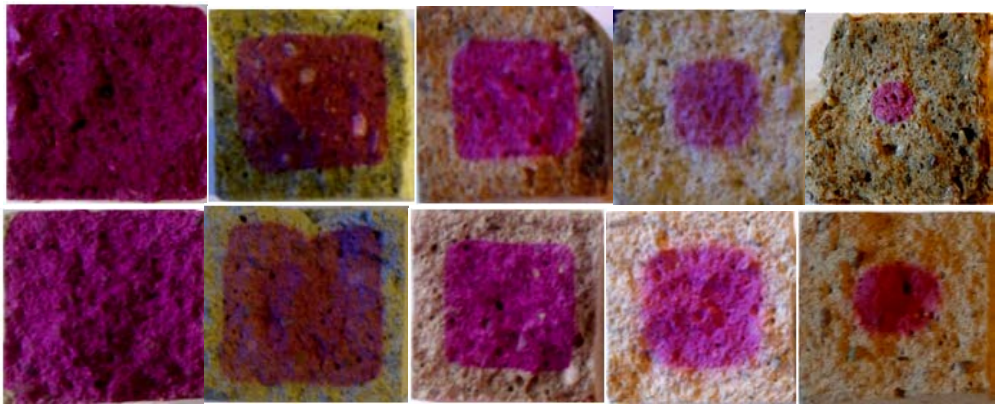

Plate 2: Phenolphthalein test results on uncarbonated samples subjected to NA_4NO_3 at 0-4-9-16-25 days (top NHL2, bottom NHL5)

The second test run measured the dissolution front by spraying the samples with phenolphthalein solution at designated time intervals, measuring the distance from the outside, to where the boundary of $Ca(OH)_2$ material remained. This is shown as the dark regions in plate 2 and reflects an alkalinity pH 8.6-12. The un-carbonated NHL2 samples leached $Ca(OH)_2$ at an accelerated rate compared to the un-carbonated NHL5. The advancing dissolution front correlates with the physical testing results attained over the initial 36 days. The increase in the depth of dissolution front of the $Ca(OH)_2$ can be directly related to an increase in sorptivity, and a decrease in the compressive and flexural strengths. The increased rate with which the NHL2 samples leached can be attributed to the quantity of $Ca(OH)_2$ contained within the material. It is reasonable to assume that this situation leads to a greater proportion of the composition of the material being lost via dissolution as the front advances through the sample; increasing the pore size, and pore interconnectivity.

CONCLUSIONS

These results confirm that the ammonium nitrate extraction method accelerates the leaching of $Ca(OH)_2$, or un-carbonated components of the mortar samples. This is evident by the phenolphthalein test results that clearly show the leaching front of the un-carbonated components and complete $Ca(OH)_2$ loss was noted by 36 days. This is important as it highlights the vulnerability of un-carbonated lime to saturated environments especially over longer time frames.

This information has practical implications for the performance of lime mortars and will have the greatest influence on binders containing a higher proportion of $Ca(OH)_2$, such as NHL2. Freshly placed lime mortars have been shown to have a greater resistance to $Ca(OH)_2$ loss than would have been initially expected. This will go some

way to alleviate performance fears of lime mortars that are inadvertently saturated. Practically, this preliminary study illustrates the significant alteration in the materials properties. It is evident that long term saturation of masonry and associated mortars should be considered when evaluating traditional and mass masonry structures. The loss of binder results in a reduction in both compressive and flexural strength and can also be correlated with an alteration in the moisture transfer properties of the samples. These characteristics are important to attain a better understanding of mortar performance but should be seen within the context of an early stage development of a wider range of tests. When combined these should enable a rigorous method for predicting the impact of the physical performance of binder loss to be achieved.

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BUILDING INFORMATION MODELING (BIM) FOR CONSTRUCTION CURRICULUM: THE SYSTEMATIC COURSE DEVELOPMENT PROCESS

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ABSTRACT

To develop a BIM course for construction programs, a systematic course development approach should be used. The approach presented in this paper has three stages, including preparation, development, and improvement. During the preparation stage, a syllabus review needs to be conducted to identify and evaluate the BIM courses currently offered by construction programs; an extensive literature review needs to be performed to identify current trends in the industry; and the survey needs to be implemented with professional BIM experts to prioritize the essential and necessary areas in BIM education. The development stage consists of framing a BIM course, setting goals and objectives, choosing and organizing the course contents, and planning the course schedule. At the improvement stage, the proposed course is improved, reviewed, and evaluated by BIM experts from the industry and academia through a detailed feedback process. From this systematically developed BIM course, students in construction programs will learn basic knowledge of BIM; the importance and applicability of BIM to the project; the basic BIM software skills; and the future direction of BIM in the construction industry. Furthermore, students will be able to understand the importance of collaboration among project stakeholders and the advantages and pitfalls of BIM.

Keywords: building information modeling, BIM education, construction education, course development, undergraduate curriculum

INTRODUCTION

BIM has quickly gained momentum in the construction industry. This momentum is shared by professional and industry organizations including the American Institute of Architects (AIA), the Associated General Contractors (AGC), and the American Institute of Steel Construction (AISC), as well as public sector bodies such as the U.S. General Service Administration (GSA). Many of these organizations have issued BIM guides and appropriate contract forms, such as the Consensus DCCS 301 BIM Addendum and the GSA BIM guide (Young, et al. 2009). Even though BIM has been

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widely adopted in the construction industry, one of the key constraints limiting those companies seeking to utilize BIM is the lack of personnel with BIM skills. Many panel participants in the AISC and ACLL eConstruction Roundtable identified the lack of knowledge among practitioners who were otherwise ready to move the industry into the BIM age as a major bottleneck (Harmann and Fischer 2008). Young, et al. (2008) agreed, pointing out that the lack of adequate training is the greatest challenge to adopting BIM in the construction industry. Furthermore, the *SmartMarket Report* (Young, et al. 2009) suggested that to maximize the values and benefits to be gained by fully utilizing it, the process of adopting BIM goes far beyond simply creating a group of users within a company. In short, the construction industry needs to focus on BIM education and training to improve the business value of BIM.

Construction programs in higher education have a vital role in BIM education. Offering BIM education for construction graduates can lower the burden of construction companies on BIM training. Many educators have been interested in BIM education in construction programs. Sabongi (2009) studied how BIM was being implemented in the undergraduate construction curriculum. Becerik-Geber, et al. (2011) also studied the level of BIM integration into the current AEC curricula and identified the reasons for not incorporated BIM into the curriculum.

Multiple scholars have emphasized the importance of BIM education in construction related programs (Sacks and Barack 2010, Sylvester and Dietrich 2010, Peterson, et al. 2011, Wong, et al. 2011). Clevenger, et al. (2010) described the approach taken by Colorado State University's Construction Management Department to promote BIM-enabled learning. The effectiveness of BIM instruction was examined in studies conducted by Azhar, et al. (2010). All these scholars asserted that the students graduating from construction programs should be fully equipped with the BIM knowledge and skills they will need in their future careers.

BIM education in the construction program is still in the early adoption stage, even though several construction programs have offered BIM courses to their students. It is clearly necessary to develop BIM courses in all construction programs, which ultimately produces future leaders of the construction community who will change the industry paradigm during the course of their careers. This study adopted the Tyler Model (Tyler 1969) to develop a BIM course and therefore followed this model's three stages of development: curriculum preparation, curriculum development, and curriculum improvement (Ornstein and Hunkins 1998).

RESEARCH OBJECTIVES, PROCEDURES, AND SCOPE

The goal of this study was to develop a course entitled "BIM in Construction Management" for undergraduate construction students using Tyler's course development model. To accomplish this goal, three research stages consisting of *preparation*, *development*, and *improvement* were created. The course "BIM in Construction Management" developed as a result of this study is designed specifically for undergraduate students in construction programs. This course planned an introductory course that introduces students to fundamental BIM principles and skills over the course of one semester and will benefit undergraduate construction management students who are preparing for future careers in the construction industry.

PREPARATION STAGE OF BIM COURSE DEVELOPMENT

The course development began by identifying the precise needs of the construction students for whom the curriculum was intended. To identify the purposes, benefits, and challenges of BIM implementation in the construction industry, the authors interviewed BIM directors or managers in construction companies. Through the interviews, the authors also identified their general expectations regarding the level of BIM knowledge and skills from construction graduates when making new hires. The authors also developed a survey instrument to probe BIM practice and needs in the construction industry, prioritize the areas of BIM implementation considered important by BIM professionals, measure the relative importance of BIM knowledge and skills required for construction graduates, and identify the types of BIM software they expected their graduate recruits to be able to use. The survey was then distributed to BIM directors or managers at ten construction companies via a web survey tool. The survey results provided valuable guidance on how to organize the content of the BIM course being developed.

Through all these steps mentioned above, it was possible to develop learning goals and objectives, learning topics, instruction methods, and assessment content in the development stage for the course development.

DEVELOPMENT STAGE FOR BIM COURSE DEVELOPMENT

The development stage for course development was composed of five sub-stages which are the most important procedures in the systematic course development process. First, the *basic framework* for the BIM course was created (see Table 1 and Figure 1) based on the inputs from BIM professionals.

Table 1. Characterization of the Course

Course Name	BIM in Construction Management
Target	Junior or senior students in an undergraduate program
Prerequisites	Fundamental construction courses such as construction methods and materials, building structures, plan analysis, electrical and mechanical construction, construction estimating, construction planning and scheduling, and contracting
Course Description	This course will introduce fundamental BIM knowledge and skills involved in the construction process. Topics include visualization, communication, MEP coordination, practical BIM implementation, and relationship between GC/CM and other stakeholders. In addition, this course will utilize several basic software packages including Navisworks, Revit, and Google SketchUp with case-based instruction. A variety of activities and instruction sessions will familiarize students with the use of BIM software.
Learning Outcomes	Upon successful completion of the course, students will be able to describe BIM applications in the construction industry, explain how they are implemented in construction projects, apply their BIM knowledge and skills to actual construction operations, and analyze how BIM can improve a number of different construction processes.

Second, the *learning goals and objectives* were developed (see Table 2), considering BIM practice in the construction industry and the industry expectations of the new course. In addition, the authors reviewed existing BIM related courses in construction programs to analyze how the BIM education is currently offered. When necessary, the authors then contacted the instructors of those courses to request more information on the course.

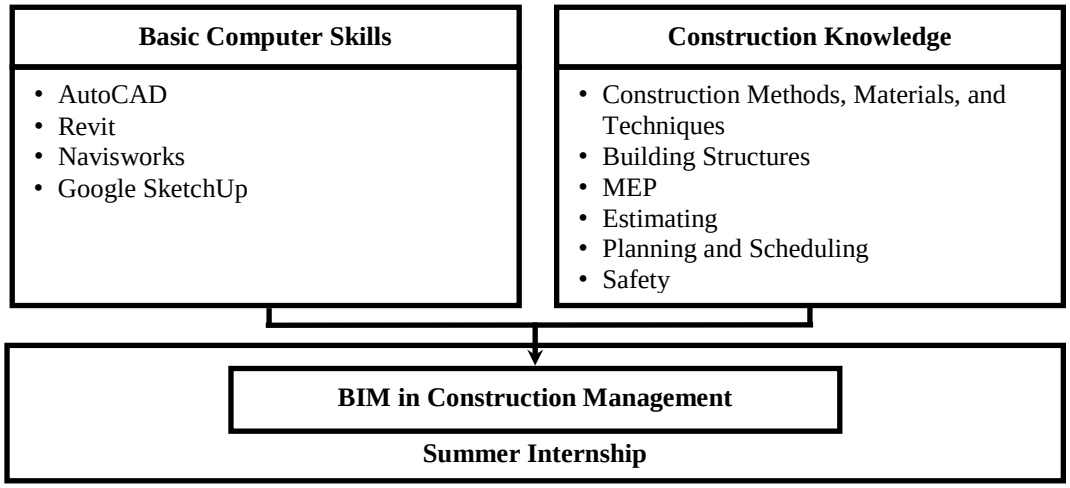

Figure 1. Framework of the Course

Third, appropriate *learning topics* were chosen by considering their relevance to the learning goals and objectives identified (see Table 3).

Table 2. Learning Goals and Objectives for the Course

Learning Goals	Learning Objectives
1. Have a general understanding of BIM knowledge and skills	1.1 State the definition and concept of BIM 1.2 Identify current trends for BIM in construction 1.3 Outline the importance of BIM implementation 1.4 Recognize the history and trends of computer-based modeling 1.5 Describe terminology of BIM
2. Comprehend the concept of BIM as applied in construction	2.1 Explain BIM practices in the construction industry 2.2 Distinguish stakeholders and their roles in BIM 2.3 Summarize how an Integrated Project Delivery System and Lean construction function in a construction project 2.4 Discuss why BIM is important in construction management 2.5 Indicate the benefits and its costs associated with implementing BIM in construction
3. Analyze BIM implementation in construction process	3.1 Compare BIM processes with conventional construction processes 3.2 Breakdown the areas of BIM implementation in construction 3.3 Appreciate the importance of a collaborative environment 3.4 Analyze a BIM implementation plan and contract 3.5 Identify and criticize collaborative work 3.6 Select the strategies of communication and collaboration in a project
4. Apply BIM knowledge to case situations	4.1 Demonstrate basic computer drafting skills 4.2 Manipulate multiple object models to create a single model 4.3 Relate schedule or estimating to BIM models 4.4 Discover the difference and difficulty of different BIM software use
5. Evaluate the future direction and application	5.1 Predict future trends for BIM in construction 5.2 Assess new opportunities for BIM, IPD, and learn construction 5.3 Explain new opportunities for using BIM for facility management and energy modeling 5.4 Support or judge the industry using BIM

Fourth, *content and instructional strategies* were developed (see Table 4), considering that (1) the total time given to each element of the course and the balance between theory and practice should be appropriate and (2) the content should be pitched at an appropriate level for students. In addition, the authors concentrated on matching the selected learning topics with appropriate instructional strategies. However, the choice of the instructional methods considered most appropriate to the subject and intended learning is totally up to the instructor.

Table 3. Learning Topics for the Course

Learning Topics	Sub-Topics	Related Objective
Background knowledge of BIM	• Definition and significance of BIM	1.1 / 1.3 / 2.4
	• Basic background of BIM and computer modeling	1.4 / 4.1 /4.2
	• Terminology of BIM	1.5
	• Practical approaches to BIM	2.1
	• Issues and opportunities for BIM implementation	1.2 / 2.5
BIM in Construction	• Stakeholders and their roles in BIM	2.2
	• Collaboration among stakeholders	2.1 / 2.2 / 3.5 / 3.6
	• BIM applications in construction projects	3.1 / 3.2
	• BIM standard and implementation plan	3.4
	• Rationale and value of BIM in construction	2.4 / 2.5 / 3.3
	• Contemporary trend in BIM research and practices	1.2 / 2.3 / 2.4
	• BIM software for construction	4.1 / 4.2 / 4.3 / 4.4
	• Future trends for BIM and new opportunities in construction	5.1 / 5.2 / 5.3
Analytic Assessment for BIM	• Critical analysis of current BIM cases	3.2
	• BIM analysis for construction process	3.1 / 3.3
	• Analysis strategies for BIM	3.4 / 3.6
BIM Implementation	• BIM practices and process	2.3 / 3.1 / 3.2
	• Case study related to BIM	3.2 / 3.3 / 4.3
	• Course projects using BIM	3.2 / 3.3 / 4.3 / 4.4
	• Internship or practicum field trip	1.2 / 5.4

Table 4. Course Content, Description, and Instructional Strategies

Course Content	Description	Instructional Strategies
1. Class Orientation	• Explanation of course syllabus • Introduction to assignments • Assigning groups for activities • Describing the field trip and guest lectures	Instructor's lectures
2. Instructor's presentation on BIM	• Explanation of BIM issues in construction • Definition and trends in BIM • Stakeholders and their collaboration • Value and opportunities of BIM • Main causes of BIM issues • Reading articles and cases on the use of BIM in construction	Instructor's lectures Assignment # 1 Group discussion # 1 Group discussion # 2 Assignment # 2
3. Learning about BIM practices and processes	• Explanation of BIM construction practices and processes • BIM standard and implementation plan • Roles and responsibilities of project stakeholders (Contract) • Issues and concerns of BIM application and adoption of the process • Areas of BIM application	Instructor's lectures Guest lectures Assignment #3 Assignment # 4 Group discussion #3
6 Learning BIM software (visualization tool)	• Google Sketchup • Revit • Navisworks • Introduction of other BIM tools	Instructor's lectures Guest lectures Assignment #4 Assignment #5 Assignment #6

7 BIM Implementation Case Study	• Analyzing the building elements of BIM in actual cases • Identify issues of construction operations • Developing alternative solutions and recommendations	Instructor's lecture Guest lectures Group project report Group work & presentation Peer evaluation
8 Field Trip and/or Guest Lectures	• Observation of practical BIM operations in a construction company • Application of actual BIM practices and processes • Issues and concerns related to BIM implementations in the industry	Guest lectures Group discussion # 4 Assignment #7 Field trip report
9 Future Direction of BIM Use	• Extensions of BIM use in construction • Future directions of BIM use	Assignment #8 Group discussion # 5

Finally, *assessment plan* was organized (see Table 5) to measure students' performance from a pedagogical perspective. Assessments must confirm that students have achieved the learning outcomes in various contexts and that the content has indeed been covered (McKimm 2007).

Table 5. Assessment content for the Course

Assessment Content	Percentage (%)
1. Assignments • Summarize practical BIM definitions • Review different journal articles related to BIM implementation in the construction industry • Summarize BIM practices and process • Develop, modify, and update BIM models with BIM Software • Write a field trip report • Describe future directions for BIM	50%
2. Presentations • Group presentations on approaches to implementing BIM analysis and identifying issues in actual BIM models • Group presentations on possible solutions and recommendations for construction operations	15%
3. Group project reports • Conceptual design model • More complete design model • Estimating and pricing using BIM • Spatial coordination and clash detection • As-built model for facility management	30%
4. Participation • In-class activities and a field trip • Group discussion	5%

IMPROVEMENT STAGE OF BIM COURSE DEVELOPMENT

Since curriculum development is a process that continuously strives to find new, better and more efficient ways to accomplish the task of education, it is extremely significant to actively engage in curriculum improvement (Oliva 2008). Thus, an evaluation and improvement exercise was performed with a BIM expert group in construction to improve the proposed course. Four industry BIM experts and four academic professors who teach BIM courses in construction programs provided their

own inputs of the course. Based on their comments and suggestions, the first draft model of the course plan for 'BIM in Construction Management' was improved and modified prior to its implementation in construction program. This improvement process will be iterative to improve and modify the course if there are opportunities to improve students' learning, new software and tools associated with BIM and new trends in the construction industry.

CONCLUSIONS

Based on the BIM education needs identified, the new course of "BIM in Construction Management" was created for undergraduate construction students, following the steps in the systematic course development process. The new course can be offered in the second semester of their junior year in the construction program to teach BIM related knowledge and skills. By taking this course, construction students will become familiar with BIM and its practice and thus will be ready to play a full role in their future careers as BIM managers in the construction industry. The major contribution of this study is to guide construction educators and programs seeking to develop a BIM related course for their construction curriculum. Through this study, construction educators can benchmark the outcome of this study to efficiently develop BIM courses for their students. Thereby, the construction industry will be able to recruit construction graduates who have BIM knowledge and its implementation skills in construction projects.

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DELIVERING CONSTRUCTION EDUCATION FOR THE NET GENERATION

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ABSTRACT

Research across academic undergraduate majors has indicated that college students of today, known as the Net Generation, learn in ways very different from previous scholars. In 2009, McWhorter School of Building Science at Auburn Universityused focus groups to evaluate how construction management (CM) students learn best. Significant differences were noted between content and delivery issues provided and the user-centered, student perceived needs and wants. Specifically, Auburn University realized key needs in areas of online learning, applied lab environments, and the variety of curriculum offerings. This study recalls student responses and provides Auburn University actions to each of those areas. Key actions include the development of an online learning academy and the construction of a field laboratory. Responding to Net Generation preferences represents a significant departure from standard practices of finding students to fit an existing curriculum; instead, this model seeks to find educational delivery and assessment methods that most appeal to students and allow them to learn best.

Keywords: curriculum, millennials, net generation, student preferences, teaching strategy

INTRODUCTION

In 2009, the McWhorter School of Building Science at Auburn University conducted a study to determine how construction management students of the current generation learn best. This study included background research across all curriculums and specific focus group studies on students enrolled in the construction management program. Results indicated that students of the Net Generation wanted less rote lecture, less textbooks, and more active, hands-on learning. In response to this, the McWhorter School of Building Science has

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started the development of an online learning academy and a field laboratory. This position paper presents a discussion of these two initiatives. It is hoped that by disseminating this information, the University can initiate a discussion on active learning within the construction context and receive feedback to improve these initiatives.

The authors believe that the classroom of the future will be very different from the traditional model of the "wise professor" on stage. Specifically, a successful future classroom will offer applied, problem-based learning strategies while allowing time and facilities for "hands-on", applied experiences. This approach essentially matches the research data provided by students on how they perceive they learn best. The balance of this paper describes the research that led the authors to pursue new delivery strategies, considers the pros and cons of such an approach, describes what the program has done to date and what is planned, and presents preliminary responses by students and industry.

BACKGROUND RESEARCH

As part of a curriculum review that examined "what" was taught in the classroom, faculty at McWhorter School of Building Science at Auburn Universityalso researched "how" material should be delivered and assessed. Should classes continue to be delivered "lecture" style, or should new ways of delivering the material be considered?

What works best for typical undergraduate students

The "Millennial" or "Net" generation, born between 1980 and 2000, is today's undergraduate student. Their expectations have been shaped by today's culture which identifies with iPods®, cell phones, web surfing, and text-messaging. The needs of this student have been addressed by several authors to include ten themes (Brown, 2002; Frand, 2000; Howe & Strauss, 2000; Merritt, 2002; Oblinger, 2003; Skiba, 2005; Tapscott, 1998):

- Fierce independence
- Emotional and intellectual openness
- Inclusion
- Free expression and strong view
- Innovation
- Preoccupation with maturity
- Investigations
- Immediacy
- Sensitivity to corporate interest
- Authentication and trust

None of the above themes resonate with the typical authoritarian, fact-based learning of a typical lecture environment. Based on studies from the Department of Education and employers, Dr. Dee Fink (2007) argues that there is evidence that today's students are not having "significant learning experiences" in a lecture environment. Evidence exists that indicates delivering material based on student desires could lead to more significant learning experiences. These learning experiences include:

- Want material available 24/7/365 (Fraud, 2000)

- Desire open, one-on-one connection with faculty who take personal interests (Teaching the Millennial Generation, 2006)
- Desire immediate feedback (Carlson, 2005)
- Have a fascination with new technology (Howe and Strauss, 2000)
- Has a bias toward action wanting to apply knowledge gained (Brown, 2002)
- Want experiential and hands-on learning (Rogers and Freiberg, 1994)
- Enjoys working in groups (Howe and Strauss, 2000)
- Want interaction with students and faculty (Oblinger and Oblinger, 2005)
- Demand learning in a variety of ways (Oblinger and Oblinger, 2005)

What works best for Auburn Universityconstruction management students
Student focus groups met over a three month period in 2009. All students were enrolled in the Construction Management program at Auburn University. Key conclusions from the study included the following:

- Students want experiential learning activities.
- Multiple, smaller handouts are preferred over textbooks.
- Students demand easy contact with professors through a variety of means.
- Students like team work but do not want to work with those outside their major.
- Flexibility in all aspects of delivery and assessment is important to students.

SHOULD STUDENT PREFERENCES CONTROL TEACHING METHODS?

Do not abandon what has worked for years.
Not all agree that a customer driven approach to delivering education is best. One linguistics professor at American University said she felt pressure to "shorten lectures, increase group-discussion time, and ignore the 'multitasking' student who is e-mailing his friends in the back of the room" (Carlson, 2005). Some faculty report that listening in such an environment is distant, and faculty can be easily distracted. Others argue that lecture based education has served the industry well and moving away could discount the educational experience.

The student is the customer.
In the age of information technology, universities must reinvent themselves to continue being relevant in modern society. Curriculums must include project-based learning and address real-world questions that matter. Textbooks and a lecture style approach to delivering education will not work with this generation. A new way of delivering the curriculum is required. Professors must become conductors of groups that turn information, gained from a variety of sources, into knowledge. There must be a clear connection with what they are learning and how it prepares them for life in the real world. Professors must continue to instill curiosity, and they must be flexible in how they teach.

Finally, faculty must excite students to be lifelong learners so they may respond in a world that is changing so rapidly around them.

THE ONLINE ACADEMY

Traditionally, higher education has been based on the premise that knowledge and teachers are in short supply. With modern technology and expansion of higher education providers, knowledge is available on demand. Knowledge can now be transferred at any time and at a pace convenient to the student. This evolving trend has been the subject of much discussion within the McWhorter School of Building Science. The summation of those discussions is that the school seeks to leverage emerging technologies and practices to enhance existing delivery of undergraduate and graduate classes.

One particular approach to deliver material is to expose knowledge in small segments, through such entities as the "Khan Academy". The academy (www.khanacademy.org) is the use of 7-10 minute videos that provide information about a specific topic. The New England Journal of Medicine is a good example of a discipline specific resource for instructional videos in clinical medicine (http://www.nejm.org/multimedia/ medical-videos). These videos are vetted through a peer review process to validate content. The McWhorter School of Building Science plans to use this format coupled with online delivery to build brand, enhance student learning, and provide additional class time for applied learning experiences. These videos may be used as an initial entry into online educational programs for the school. These teaching tools could also be vetted through a peer review process.

What we have done to date…

Approximately 20 videos have been created to date by a combination of students and faculty. These videos are available at http://www.auburnccic.org/ and at itunesU (Figure 1). An initial evaluation ruberic to measure quality of videos has been developed. Currently, videos are being reviewed in-house only. These videos will serve as the anchor for the online academy.

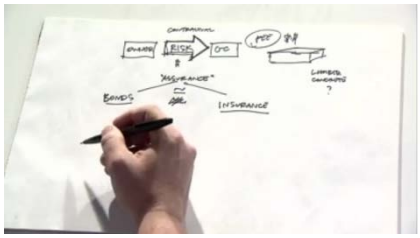

Figure 1: Sample screen-shot of video of insurance vs. bonds.

The target audience for each of the videos is our undergraduate student with little or no experience in the construction environment. Typically, this student is 18-22 years of age and has at least one year of college experience. Currently, we are serving our target audience using classroom lectures and textbooks. This project seeks to partially replace that mode of delivery with some short videos.

The target audience needs a fundamental vocabulary in construction terms and practices. Specific skills needed by the students include the need to interpret contract documents, estimate the cost of work, schedule a typical construction project, and manage risk. From a broader perspective, the McWhorter School of Building Science wishes to create students that are lifelong learners, solve problems effectively, and have an appreciation for the greater society in which they work.

The videos will be academically inspired but will focus on relatively simple individual concepts. Information in the video will not assume previous knowledge but will not be so simple that they do not appear professional.

Informal initial surveys of online videos of this nature have helped establish our frame of reference. Students specifically like RSA Animate (http://comment.rsablogs.org.uk/videos/). Specifically, they like the graphical nature of the presentation and believe the voice is excellent. Students do not appreciate so many "clever remarks" in many of these videos. Students appreciate some of the Khan videos. They especially like the ones where the reason for understanding the topic is clearly explained and the ones that take the complex and make it simple. Special care will be required to avoid videos that could become an extenuation of the "lecturer" at the front of the classroom. Videos must engage the learner.

Student reviews have been positive on the first set of videos responding that they liked the ability to watch the sessions multiple times, and they appreciated the additional class time to apply the concept.

What we plan to do…

By the end of calendar year 2012, the authors hope to have 100 videos online available free to the public. Viewers will have the opportunity to comment on the videos and offer feedback as part of a continuous improvement process. It is hoped that this will create a "critical mass" of videos that will allow for sufficient user-feedback and response.

If successful, other universities and professional practice could contribute to the online academy providing an easily accessible, free resource for learning in construction education. The academy could also provide an excellent resource for faculty to disseminate and receive tangible feedback on issues critical to construction.

THE FIELD LABORATORY

A recently completed curriculum review involving participation from faculty, students and industry stakeholders identified a need to expand the practical component of Auburn University curriculum. The new curriculum which comes into effect in the fall of 2012 has dedicated practical lab sessions in four classes per semester. Two classes are 3-hour structures labs where methods and materials of construction will be the focus. Two classes are 2-hour mechanical,

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electrical, and plumbing labs where systems will be the focal point of application. This increase in practical lab sessions will increase the demand for space in our demonstration lab which is already over used. Some lab sessions are conducted outside our current lab space; however, that area is confined and not suitable to activities of scale.

Other construction programs (University of Florida, Wentworth Institute) have established external construction demonstration areas close to where their instructional activities occur. Such an approach would be best; however, it would require significant development not in keeping with the university master plan for the central campus. Thus, a site was located on University property approximately one kilometer from the main CM classroom building that would serve as a field laboratory. The site is approximately one acre in size and is located on a flat site with available on-site parking near a campus bus route (Figure 2).

Figure 2: Field laboratory with job site trailer in background.

What we have done to date…

Work to date has focused on developing a safe, usable site. The site has been fenced, and water as well as electrical supply have been provided to the site. A job site trailer with meeting space for up to thirty students has been added complete with internet access. A steel shipping container has been placed on the site for tool and material storage.

Some preliminary student and faculty activities have been held at the site. It was decided that some activities would require a concrete slab as a flat working area. The slab could be used for wall framing, form work, masonry work, and various demonstrations.

A working slab of approximately 30'x40' was placed by a concrete class. Students planned, managed, and executed the work of placing the slab. This slab has already been used for "brick day" where masonry professionals work with groups of students to lay brick walls. In this class the bricks are reused, but there is the possibility for the construction of permanent structures.

A faculty research project is also ongoing on site where a pervious concrete slab has been placed along with stormwater collection devices. This project will measure the thermal effects of pervious concrete on stormwater pollution.

A project by a graduate student involves the installation of a field bed for a geothermal HVAC system to test the heat dissipation properties of three subsoil mediums. The system will be permanent to allow further testing of geo-thermal HVAC systems to find ways to make residential systems more efficient.

What we plan to do…

Opportunities at the site abound. Immediately, we plan to use the site for some specific exercises:

- Erection of a small, two-story steel frame as part of a steel design class
- Erection of an elevated pan form system as part of a temporary structures class
- Installation of wood trusses to demonstrate bracing requirements
- Construction of wood framed wall forming system as part of temporary structures class
- Demonstrations of safety devices and safety training
- Demonstration of equipment

Longer term, the school would like to develop a few minor structures on the site. These structures will be designed and constructed as part of the curriculum and will be privately funded. Some of these may include:

- Construction of aggregate bins and mixing area to allow the building of concrete projects
- Erection of a wind turbine
- Stormwater protection devices
- Mock-ups for building systems

Over time new uses for the facility will be found including the following:

- New labs for the existing classes
- New elective classes developed around the field lab
- Graduate students expand vision on possible capstone projects
- Faculty pursue new research activities
- Industry can partner with the students and faculty to solve problems

The program's construction industry council visited the field lab, and the response was very positive. Not only did the industry professionals see the value of the field lab, several members offered resources to elevate the capabilities of the lab.

AUTHOR'S ANALYSIS AND CONCLUSIONS

In an effort to meet Net Generation desires for how the curriculum is delivered, Auburn University's Building Science School has developed an online academy consisting of 7 ½ minute videos that provide answers to tangible questions in construction management and a field laboratory. These developments are in direct response to student focus group surveys (Table 1).

Net student desires….	**Response by CM Program**
Experiential learning activities	Field Laboratory
Multiple, smaller handouts over textbooks	Short online videos may replace pre-class textbook assignments
Easy contact with professors	NA
Team work within the major	Use videos to make time available in class

	for applied group work; use teams in field lab
Flexibility in all aspects of delivery	Online videos available 24/7/365

Table 1: How the field lab and online video program respond to student desires

Faculty training is needed to assure that both the field laboratory and online learning academy are implemented in a way that will enhance student learning. The field lab must be used regularly on meaningful, applied problems critical to construction management. These problems must be relevant to the students. The online learning academy will provide additional class time for applied, experiential learning endeavors. Faculty must move away from designing rote lectures toward the design of engaging student discussions and case studies.

Much research has been published on "flipping the classroom" where online material is used to convey understanding, and the concept is applied in the classroom (Berrett, 2012). This paper proposes "flipping the classroom" and providing meaningful, "real world", applied labs. In combination, this approach has the potential to "hand spring" construction management forward and produce the future leaders of construction.

Future research is needed to assess the two initiatives. Student focus groups should be developed that provide feedback on both online videos and the field lab. A ruberic to measure student learning outcomes was developed and implemented prior to changes in the way the curriculum is delivered. The researchers believe that such a ruberic may help measure how effective the field laboratory and the online videos are as delivery vehicles.

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DEVELOPING A GRADUATE COMPETENCY MAPPING BENCHMARK FOR QUANTITY SURVEYING COMPETENCIES

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ABSTRACT

An investigation into the views of industry and academia on Quantity Surveying (QS) education revealed that there is a considerable gap in the expectation of graduate competency and the achievement of it. It identified the need for deeper investigation into the root causes of this gap between expectation and provision of QS competencies. This paper presents an in-depth analysis of Royal Institution of Chartered Surveyors (RICS) QS competencies and their mapping to four RICS accredited QS programme specifications taken as case studies. The mapping is detailed and carried out in a dual vector scale matrix encompassing the breadth and depth of achievement of competencies. The mapping case studies form the basis for the development of a conceptual benchmark for achievement of graduate competencies. The detailed mapping exercise analyses the level of mapping of individual module specifications of RICS accredited programmes to the three levels of achievement of competencies specified by the RICS. The research purports to use an industry –academia industry forum to evaluate the conceptual benchmark in order to adjust and ratify the final benchmark values. The benchmark will define the threshold levels at which all competencies need to be achieved by graduate quantity surveyors.

Keywords: competency mapping, conceptual benchmark, graduate quantity surveyors, QS degree programmes, RICS Competencies.

INTRODUCTION

In the knowledge society, higher education has an important role to play in the development of the professional. To remain industry relevant, Higher Education providers in the design and delivery of study programmes need to understand industry expectations while complying with professional body requirements. The influence of industry upon curriculum development is becoming ever more significant in the fast changing world (Mekenzie, 2010). However, research revealed that current curriculum design and development do not always reflect industrial practice and

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workplace reality (Perera and Pearson, 2011). There are a series of gaps between university education and industrial demand such as; over education and skills mismatch, etc. (Korka, 2010). Furthermore, Korka (2010) argues the insufficient involvement of professional associations and of employer representatives in the shared responsibility for higher education learning contents and learning outcomes.

The recent RICS report indicated that a similar scenario exists in construction and specifically in RICS accredited QS degree programmes (Perera and Pearson, 2011). The report revealed that there is a considerable gap between the industry's expected competency of graduate QS and what is actually attained. As a result, RICS degree programmes often produce graduates who are not fit for purpose hence there is confusion and dissatisfaction in the industry as to graduate QS competency. Perhaps those in academic circles are not aware of what the industry really wants because of misinterpretation and lack of proper attention, or the industry has unrealistic expectations. This is increasingly debatable. In fact, these two appear to be the case according to Perera and Pearson (2011). The current research is thus a further investigation and development of the initial RICS report which revealed these incongruities. The aim of this paper is to present the development process of a minimum benchmark for achieving competency in Quantity Surveying graduate education.

RESEARCH METHOD

Previous research established that there is indeed a gap between actual academic attainment and industry expectations of graduate QS from RICS accredited institutions. The current research sought to develop a benchmark that satisfies the aspirations of the various industry stakeholders. The main research instruments to be used to achieve this include case studies and expert forum interviews (see Figure 1). Detailed case studies were used to generate a conceptual benchmark to be later refined using the views of an expert forum comprising of academics and industry to finally produce the minimum benchmark. The current paper reports the results of the case studies resulting in the conceptual benchmark. The development of the final benchmark is currently underway and hence not reported here.

The case studies include examination of four RICS accredited QS degree programmes. The curricular of these programmes (module specifications) were mapped against RICS QS competencies at detailed level using coverage (as a breadth measurement) and amount of time spent i.e. module credits (as a depth measurement). The ensuing mapping was then verified for accuracy and consistency with programme directors responsible for delivery of these programmes.

Breadth measure

RICS QS competencies are analysed at a detailed level using the QS Study Checklist (RICS, 2008). This checklist is used as the framework for developing the conceptual benchmark where 1 and 0 is used to indicate coverage of a topic under a competency.

1 - Reflects that the topic is dealt with by the degree programme concerned.

0 - Reflects that it is not dealt with by the degree programme concerned.

These are analysed against the three level classification of level of achievement by the RICS (RICS, 2009). These are as follows:

Level 1 - Knowledge and understanding

Level 2 - Application of knowledge and understanding

Level 3 - Reasoned advice and depth of technical knowledge

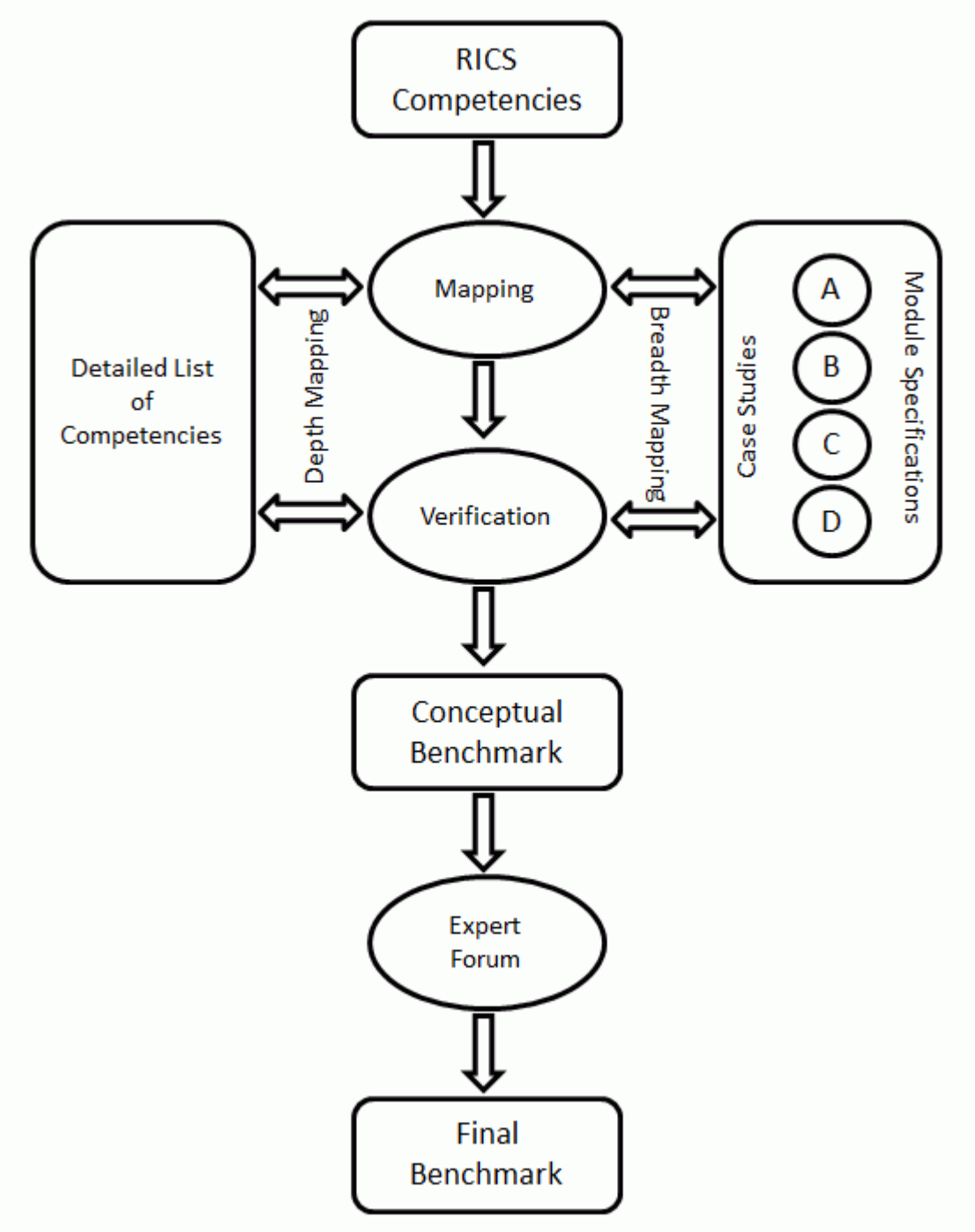

Figure 1 Research Method

A specific topic may be covered at both Level 1 and 2. In this case, there is a value 1 against both Level 1 and 2 columns. In another topic, if the topic is dealt with at Level 1 only then values 1 and 0 were placed against columns Level 1 and Level 2 respectively. Level 3 achievements are not covered in degree programmes as it is not practical to expect a graduate to cover a competency at Level 3. However, as the outcome of these case studies reflects a minimum conceptual benchmark, it will not prevent anyone achieving a competency at Level 3.

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Depth measure
This reflects the amount of time spent on achieving a competency. In degree programmes, time spent on achieving module outcome is stipulated as Credits. Where 10 hours spent is considered as 1 Credit, a typical 20 Credits point module reflects 200 hours of learning by the student. This constitutes direct contact with formal teaching; lectures, seminars, tutorials as well as students' expected study time on the module content (time spent on their own). The depth measure is only indicated at competency level and not at topic level as it is impractical to stipulate expected number of study hours spent at a detailed topic level. A percentage score is used to indicate the proportion of time spent on each competency. This will provide valuable measure to understand relative time spent for each competency.

Both breadth and depth vector scale mappings of the four case studies were initially carried out using the respective module specifications of programmes. The results were then sent out to the programme leaders of the degree programmes concerned for necessary adjustments and ratifications. Descriptive statistics such as mean and percentage scores were used to analyse the results of the case studies as conceptual benchmark.

COMPETENCY MAPPING CASE STUDIES

The four case studies selected were leading QS honours degree programmes in the UK all accredited by the RICS. The dual vector scale representing breadth and depth of coverage of competencies informs the current practice in academia. There are a total of 360 Credits (3600 hours) of learning in a degree programme. Therefore typically there will be less than 3600 hours available to map against RICS competencies. The breadth mapping case studies (an excel spreadsheet with over 400 rows) cannot be presented here because of limited space. However, the depth mapping case studies (see Table 1) were based on and influenced by the breadth mapping outcomes. It reveals that competency coverage utilises 73-85% of the credit hours available on achieving RICS competencies.

CONCEPTUAL BENCHMARK FOR GRADUATE COMPETENCIES

The conceptual benchmark (see Table 1) is a dual vector matrix reflecting overall coverage and depth of coverage of the four case studies. The conceptual benchmark values reflect average levels of achievement of competencies by graduates completing a degree from any of the four case study QS programmes. It reveals under **Level 1 and Level 2** columns the topics covered in all the 4 RICS accredited degree programmes examined. A value of 1 against a particular topic implies that at least one of the case study degree programmes covers this. The **Credits hours'** column, which is the average of the four case study values, indicates typical expected times (in hours) devoted to each competency whilst the **Percentage** column shows the relative time proportion. Only a brief extract of the conceptual benchmark is shown in Table 2 due to paper limit restriction. However, the detailed conceptual benchmark follows a similar pattern to the brief presented in this paper.

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Table 1: Competency mapping case studies

	University:	**A**	**B**	**C**	**D**	**Average**	**Conceptual Benchmark as Percentage**	**Competency Percentage Total**
	Credits:	**340**	**330**	**460**	**450**			
	Hours	**3400**	**3300**	**4600**	**4500**			
Code	**Competency**							
	Mandatory Competencies							**18.0%**
M001	Accounting principles and procedures	5	0	5	5	3.75	0.1%	
M002	Business planning	30	10	5	55	25	0.8%	
M003	Client care	25	5	60	40	32.5	1.1%	
M004	Communication and negotiation	89	165	185	155	148.5	4.8%	
M005	Conduct rules, ethics and professional practice	20	30	55	10	28.75	0.9%	
M007	Data management	85	65	90	120	90	2.9%	
M008	Health and safety	30	50	40	195	78.75	2.6%	
M010	Teamworking	132	95	130	240	149.25	4.8%	
	Core Competencies							**61.6%**
T010	Commercial management of construction	50	105	120	10	71.25	2.3%	
T017	Contract practice	373	190	240	90	223.25	7.2%	
T013	Construction technology and environmental services	377	597	655	1090	679.75	22.0%	
T022	Design economics and cost planning	230	280	230	270	252.5	8.2%	
T062	Procurement and tendering	216	253	130	130	182.25	5.9%	
T067	Project financial control and reporting	65	55	63	55	59.5	1.9%	
T074	Quantification and costing of construction works	380	520	430	390	430	13.9%	
	Optional Competencies							**20.4%**
T008	Capital allowances	2	0	20	20	10.5	0.3%	
M006	Conflict avoidance, management and dispute resolution procedures	91	30	120	30	67.75	2.2%	
T016	Contract administration	50	60	82	60	63	2.0%	
T020	Corporate	0	0	0	0	0	0.0%	

	University:	A	B	C	D	Average	Conceptual Benchmark as Percentage	Competency Percentage Total
	Credits:	**340**	**330**	**460**	**450**			
	Hours	**3400**	**3300**	**4600**	**4500**			
Code	**Competency** recovery and insolvency							
T025	Due diligence	0	0	0	0	0	0.0%	
T045	Insurance	30	10	0	0	10	0.3%	
T063	Programming and planning	80	80	103	185	112	3.6%	
TO66	Project evaluation	100	45	225	220	147.5	4.8%	
T077	Risk management	60	15	110	20	51.25	1.7%	
M009	Sustainability	100	150	265	150	166.25	5.4%	
	Total	**2620**	**2810**	**3363**	**3540**	**3083.25**	**100.0%**	**100.0%**
	Relative Coverage	77%	85%	73%	79%			

Note: the depth mapping presented here is influenced by the breadth mapping not shown for stated reasons.

Table 2: Conceptual benchmark for graduate competencies (a brief extract from the detailed list)

RICS QS Study Check list	Level 1	Level 2	Credits hours	Percentage
MANDATORY COMPETENCIES			**3083**	**100.0%**
Accounting principles and procedures (M001) - Level 1			**4**	**0.1%**
Balance sheets / profit and loss account	0	0		
Taxation	1	0		
Revenue and capital expenditure	0	0		
Cash flows	1	0		
Auditing	1	0		
Ratio analysis	0	0		
Credit control	0	0		
Profitability	1	0		
Insolvency	0	0		
Legislation	1	0		
Team working (M010) – Level 1			**149**	**4.8%**
Understand the role of team members	1	1		
Appointing the project team	1	1		
Relationships with other team members	1	1		
Communicating with other team members	1	1		
Partnering and collaborative working	1	1		
Strategic alliance	1	0		
Supply chain management	1	1		
Legislation on selecting project teams	1	0		
CORE COMPETENCIES				
Commercial management of construction (T010) – Level 3			**71**	**2.3%**

RICS QS Study Check list	Level 1	Level 2	Credits hours	Percentage
Estimating	1	1		
Establishing budgets	1	1		
Cash flows	1	1		
Reporting financial progress against budget	1	1		
Procurement of labour	1	0		
Procurement of plant and materials	1	0		
Procurement of sub-contracts	1	0		
Financial management of supply chain	1	0		
Financial management of multiple projects	1	0		
Design economics and cost planning (T022) – Level 3			**253**	**8.2%**
Economics of design - site density, wall / floor ratio, storey heights, room sizes	1	1		
Sources of cost data - BCIS / in-house database / other external sources	1	1		
Inflation (tender / construction)	1	1		
Location factors, regional variations	1	1		
Currency fluctuations	1	0		
Estimating	1	1		
Cost Plans	1	1		
Cost Planning	1	1		
Life cycle costing - capital / running costs / replacement	1	1		
Value Engineering	1	1		
Value Management	1	1		
Risk Management and Analysis (contingency)	1	1		
State of the construction market	1	0		
State of the economy generally – locally and globally	1	0		
OPTIONAL COMPETENCIES				
Corporate recovery and insolvency (T020)			**0**	**0.0%**
Types of Insolvency	0	0		
Bankruptcy	0	0		
Individual voluntary arrangement	0	0		
Liquidation	0	0		
Administrative receivership / Fixed charge receivership	0	0		
Company voluntary arrangement	0	0		
Role of the QS if insolvency occurs	0	0		
Termination and suspension of contracts	0	0		
Assignment / novation	0	0		
Ownership of material and plant	0	0		
Bonds and guarantees	0	0		
RICS Information Paper on Construction Insolvency	0	0		

CONCLUSIONS

It is admissible that Teamworking (M010) under Mandatory competencies received high rating in both depth and breadth mapping as there are many project type modules in all the degree programmes examined, where students can learn this skill. On the

other hand, Corporate recovery and insolvency (T020) and Due diligence (T025) under Optional competencies have zero value against both measures. It can be argued that in modern times and recession prone graduate QS should at least have a basic understanding of some topics covered under these competencies especially; types of insolvency and the role of the QS if this occurs. One main finding under Core competencies that needs further analysis is the scope of coverage not proportionate to the devoted credits hours. This is revealed in competencies such as Construction technology and environmental services (T013) and Quantification and costing of construction works (T074).

In addition, it is supposedly good practice to have a minimum benchmark which gives proper flexibility to programme leaders to include new topics in their curricula as may be required from time to time. Such flexibility is a good idea especially in the current and dynamic business environment where innovation is encouraged. However, this minimum benchmark needs to be effectively moderated to ensure that degree programmes do indeed cover the competencies which the industry expects of graduate QSs. An expert forum comprised of 15 industry and academic experts will be used in further research to moderate the conceptual benchmark. Diverse views of the experts will be harmonised using Delphi methodology to produce the final benchmark. This will provide a minimum benchmark and a useful instrument to aid RICS accreditation of QS degree programmes. It will be a useful part in the RICS partnership deliberations to assess compatibility of RICS accredited programmes. Whilst also providing room for flexibility and innovation in curriculum development, the final benchmark will help to maintain programmes that are representative. Eventually, this will help to produce graduate QSs that meet industry expectations and stakeholder satisfaction.

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EFFECT OF PRACTICE TESTS ON OVERALL STUDENT PERFORMANCE IN A CONSTRUCTION SCIENCE COURSE

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ABSTRACT

Literature indicates that when students who take optional practice tests, they perform better in mandatory course exams than those who do not take advantage of the practice tests. The purpose of this study is to find out whether this variable makes a difference in overall student performance in an Environmental Control Systems course in Construction Science offered by the author. The idea of optional practice tests had been introduced by the author in Fall 2011. There are 105 students in two sections of the course. Data was collected throughout the semester. The variable was tested along with other factors that may have an effect on overall student performance in a course, such as home work performance, quiz performance, and gender. Multiple linear regression technique was used to perform the analysis. The findings of the study indicate that optional practice tests do have a positive effect on student performance in formal course assessment.

Keywords: Construction Science, Environmental Control Systems, Practice Tests, Student Engagement.

INTRODUCTION

Student engagement is an important aspect of learning process in an academic setting. It occurs when the learners take responsibility for their learning rather than continuing to be passive and waiting to be spoon-fed by the instructor. Increasing student engagement in classroom setting is gradually becoming important (Deeter, 2008). Student engagement with the course material is of utmost importance irrespective of the method of delivery of instruction (Lockyer et al. 2001).

In order to enhance student engagement with course materials, the author introduced online practice tests for a course in an Environmental Control Systems at an undergraduate level. The tests were voluntary. The students who took these tests received immediate feedback. The purpose of this study was to determine whether student performance at an undergraduate level is affected by the optional practice tests. The measure of student performance was the sum of a student's scores in mandatory tests.

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It was attempted to determine whether the practice tests had an effect on cumulative test grade of a student on an Environmental Control Systems course. It was also critical to find out whether this relationship, if any, existed in the presence of other possible determinants of student performance.

REVIEW OF THE LITERATURE

Student Engagement

Institutes of learning are constantly striving for improving the student learning processes through use of advanced instructional technologies. They include, among others, interactive learning methods to foster student engagement.

Effective student engagement even in classes that are of medium size is a challenging undertaking. On one hand, students have minimal opportunities to interact with the instructor and one another to construct their own understandings of the course concept in a short period of time and, on the other hand, the instructor has also difficulty in providing feedback to the students on their understanding of the concepts.

Walker et al. (2008) argue that even with large-format classes it is possible to foster student engagement through integration of active learning techniques. It can be achieved outside the boundaries and confinements of classroom settings by making materials available online. Such a format may provide pedagogically constructive opportunities such as interaction among students, active student engagement, and feedback by the instructor. Feedback is particularly important, because it gives the student an opportunity to process the materials and retain them for a longer period of time (Semb & Ellis, 1994). Students need to grasp the course materials so that they can apply the concepts correctly. Quite a number of studies indicate that apt and constructive feedback is an important factor of improved student performance (Fink, 2003; Higgins et al. 2002; Bransford et al., 1999).

Other Factors of Student Performance

Even though the purpose of this study was to find out the effect of practice tests on student performance, it was necessary to explore other predictors that may have significant relationship with this dependent variable. Class attendance is considered by many researchers as one such predictor. There is a wide body of literature that indicates an inverse relationship between academic achievement and class attendance. Student absenteeism is an important issue in institutes of higher learning in the United States. Class attendances, at least in practice, are optional in most schools. Although instructors have different outlooks and policies toward attendance, most of them would like them to attend the classes to maintain a vibrant teaching-learning atmosphere; most instructors also associate class attendance with academic achievement (Cohn & Johnson, 2006; Devadoss & Foltz, 1996; Brocato, 1989). It is generally accepted that attending classes is an important aspect of college experience (Cohn & Johnson, 2006).

Studies reveal that there is a relationship between absenteeism and student performance in courses (Brocato, 1989). The hypothesis that there is a strong relationship between class attendance and student learning has been investigated empirically in journals of

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higher education. It is not surprising that most studies have found an inverse relationship between being absent from the class and course performance (Cohn & Johnson, 2006; Murberger, 2001; Devadoss & Foltz, 1996; Brocato, 1989).

Studies have been conducted on the inverse relationship between absenteeism and student performance in different courses at college level. As long back as in the 1970's, Jenne (1973) found that attendance played a major role in a health science course. Jones (1984) reported that there is a negative correlation between absences from class and grades in a psychology course, irrespective of ethnicity or gender of the students. Romer (1993) reports a similar finding on a study related to intermediate microeconomic theory.

Devadoss and Foltz (1996) conducted a study on the effect of a number of predictor variables on performance in agricultural economics. They conclude that the study "provides strong empirical evidence of the positive influence of class attendance on student performance" (p. 506). Findings of another study on course in principles of economics show evidence of an inverse relationship between absenteeism and performance is statistically significant when students miss a sizeable number of classes (Durden & Ellis, 1995).

Investigations on relationship between absenteeism and student performance in construction science courses are negligible. However, there is on recent study by Senior (2008) that explores such relationship for course in construction management. The results of the study indicate a statistically significant correlation between missed classes and final student grade in the course.

Many courses in construction management comprise of concepts or ideas that students need to comprehend in order to succeed in follow-on courses. An in-depth understanding of the fundamentals of a course helps them transfer knowledge to from one course to another. Bransford et al. (1999) argue that it necessary for students to evaluate their learning current level of understanding continuously. In order to do that, they require constant feedback from instructors. Different methods are used by faculty at college level to enhance and improve such understanding by providing instant feedback (Freeman & McKenzie, 2001). Most widely adopted methods are giving short tests and assigning problem-solving home works.

There are, of course, few studies that report no relationship between attendance and performance. Browne et al. (1991) did not find any positive effect on attending lectures and student grades on tests in an economics course. Similarly, findings by Buckles and McMahon (1971) do not suggest any significant effect of class attendance on student performance.

Homeworks may also have a significant role to play in enhancing a student's in-depth understanding of course materials (Douglas & Sulock, 1995). Apart from being considered as tools for enhancing student learning, home works have been found to have a positive relationship with overall student performance (David et al., 2001).

The effect of one other variable on performance that has been tested by many researchers is gender. Some studies indicate that men have more positive attitude toward education in engineering and science than women (Lawson et al., 2006; Jones, 1984). It is reflected by their performance in relevant courses. However, there are other studies that do not report any correlation between gender and student performance (Lawson et al., 2006; Bond, 1998; Kreiner, 1997).

In view of the findings from this review of the literature, it was decided to include a few other variables in the model for analysis of the relationship between video-viewing and student performance. These variables include: absenteeism, home-works, and gender.

METHODOLOGY

Study Population

The study population consists of students who registered for an Environmental Control Systems course at an undergraduate level in a state university for Fall semester in 2010. There were two sections, 501 and 502, in which the students were enrolled; one section had 65 students and the other had 39. The sample size includes the total population of 104 students, 9 female and 95 male.

Data Collection

Data related to the study was collected from the instructor's own database. The same instructor taught the course in all three semesters under the study. The unit of analysis was the student.

Variables and their Operationalization

Test Grade (TEST). It is the sum of all the scores made by a student in three tests given during the semester. It was measured by the numerical grades obtained by the student in the tests.

Absent (ABSENT). It is the record indicating the complete absence of the student from class meetings. It was measured in number of class meetings missed by the student.

Gender (GENDER). It indicates the gender of a student. It was a dummy variable, operationalized by assigning a value of 1 when the gender was female and 0 when the gender was male.

Home work (HW). It is the performance by the student for a particular assignment related to a topic covered by the course and done at home. It was measured by the cumulative numerical grade obtained by the student in all home works.

Section (SEC). It indicates in which the student was enrolled. It was a dummy variable, operationalized by assigning a value of 1 if the student was enrolled in section 501 and 0 otherwise.

Quiz (QUIZ). It is the performance by a student in a short, previously unannounced, test held in the class related a particular course topic. It was measured by the cumulative numerical grade obtained by the student in all quizzes.

Practice (PRAC). It is the performance by the student for a particular assignment related to a topic covered by the course and done at home. It was measured by the cumulative numerical grade obtained by the student in all home works.

ANALYSIS

A stepwise regression analysis was performed to explore the data. This is an automatic procedure for statistical model selection in cases where there are a large number of potential explanatory variables. Forward selection procedure was used. The procedure involves selection of variables that are statistically significant. Following model was used for the purpose:

$$TEST = \beta_0+\beta_1 ABSENT+\beta_2 HW+\beta_3 GENDER+\beta_4 SEC+\beta_5 QUIZ+\beta_6 PRAC+\varepsilon \quad (1)$$

where β_0 = intercept, β_1 = the coefficient of ABSENT, β_2 = the coefficient of HW, β_3 = the coefficient of GENDER, β_4 = the coefficient of SEC, β_4 = the coefficient of QUIZ, β_4 = the coefficient of PRAC, and ε = error term.

Results

The results of the analysis are shown in Table 1.

Table 1. Statistical Analysis for TEST

Variable	Intercept	Regression Coefficient	T	p<|T|
Intercept	31.92		3.68	<0.001
HW		1.10	5.37	<0.001
QUIZ		0.89	4.12	<0.001
PRAC		0.004	3.12	0.002
F-value of the Model: 29.76	p>Model F = <0.001	Model R^2 = 0.47	Adjusted model R^2 = 0.46	

The results indicate that only HW, QUIZ, and PRAC were retained in the model. The excluded variables were ABSENT, GENDER, and SEC.

The F statistic of a model basically tests how well the model, as a whole, accounts for the dependent variable's behavior. The F-value of this particular model was found to be statistically significant at less than the 0.001 level.

An important aspect of a statistical procedure that derives model from empirical data is to indicate how well the model predicts results. A widely used measure of the predictive efficacy of a model is its coefficient of determination or R^2-value. If there is a perfect relationship between dependent and predictor variables, R^2 is 1. In case of no relationship

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between dependent and predictor variables, R^2 is 0. Predictive efficacy of this particular model was not found to be very high with an adjusted value of 0.46. But such values are considered to be satisfactory related to empirical studies in social sciences (Freund & Wilson, 1991). The independent variables included in the model explained about 46 percent of the variance.

The results indicated that overall test grade of a student in an Environmental Control Systems course offered at a state university is positively correlated with taking optional practice tests in a at the level of significance of 0.002. This relationship exists in the presence of quiz and homework performance, which are known to have some effect on overall student performance. Overall test grade is directly related to all the three variables retained in the model. The results implied that when an optional practice testis taken, the overall test grade of the student increases by 0.004 point. The overall test grade would increase by 0.89 point and 1.10 points for every point earned in a home work and quiz respectively.

DISCUSSIONS

The results of the statistical analysis are meaningful in the sense that they support the importance of effective student engagement with course materials. The study shows that student performance enhances significantly when a proper environment in developed to foster student engagement for a course on Environmental Control Systems course at an undergraduate level.

A surprising aspect of the study was the exclusion of absenteeism as a predictor of student performance. The author has conducted a number studies that indicated that students having a higher number of absences from class tend to perform poorly in an Environmental Control Systems course. One possible explanation could be that a student, without attending the classes, could have good grasp of the course contents only by studying the online materials uploaded by the instructor and taking the series of online practice tests.

A poor performance in the home works and quizzes indicate an inadequate understanding of the materials discussed in the class. They eventually affected a student's overall performance in the course.

CONCLUSIONS

The study provides a moderate support to the positive influence of optional practice tests on student performance at an undergraduate level. It is evident online practice tests have the potential of being successful instructional tools, if they are properly integrated with traditional teaching tools. Immediate constructive feedback seems to be benefit of online practice tests. In most cases, it results in fostering effective student engagement, which, in turn, enhances student performance. The study will hopefully generate enough interest

to do further research for deriving models for predicting student performance in other courses.

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FROM APPRENTICE TO MASTER OF SCIENCE IN ENGINEERING – AN EDUCATIONAL EXPERIMENT

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ABSTRACT

As a consequence of the Bologna Process Danish higher educational system has fully adopted the 3+2 system. Access to Master of Science programmes is now granted to either Bachelor of Science or Professional Bachelor degree holders. The latter is known for admitting people with vocational qualifications. Hence, it is now possible for a person to go through apprenticeship, and later entering an Architectural Technology and Construction Management education, and finally, ending with a Master of science degree. Now in its fourth year of allowing MSc students with such background, it is possible to share some of the collected experience. So far it has been a success, but there have been hurdles. Students with vocational background combined with a professional bachelor degree are different from students with a Bachelor of Science background. This applies to the areas of among others: Mathematical skills and practical knowledge. The main success is that candidates have entered the job market with high success. Data has been collected through interviews and surveys with graduates, teachers and coordinators within the new master programme in construction management at Aalborg University in Denmark. This exercise has given insight what distinguishes traditional Master of sciences graduates and these new graduates.

Keywords: construction management, education, master degree, vocational training

INTRODUCTION

The construction industry is naturally interested in the educational system as customer to our candidates. This research limits focuses to only higher educations. On one hand, the industry often asks for well-educated candidates, especially with managerial skills. On the other hand, the industry asks for candidates with practical knowledge. Often these two requests are not to match in one education. Students with vocational training or an apprenticeship certificate is a seldom at our universities. This because these people often lack the requested admission requirements achieved in upper secondary educations. So if they were to enter the university they either have to restart their education and pass through upper secondary grades or take access course. People with vocational training can instead of a university degree obtain a professional bachelor degree. Until recently there existed no continuation of a professional

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bachelor degree. This could be seen as not fully implementation of the 3+2 system of the Bologna declaration, stating that a 3 year bachelor should grant access to a 2 year master.

This research reports on a Danish attempt to fully implement the Bologna declaration, and allowing students with a 3 year professional bachelor degree access to a 2 year master programme at Aalborg University. The programme is a Cand.Scient.Techn. programme in Construction Management, hereafter referred to as CST. The aim of this paper is to share knowledge of this process and to point out challenges in allowing submission to university from students with a professional bachelor degree and apprenticeship certificate.

The Bologna process

29 European countries signed the Bologna Declaration in year 1999 (EU 1999). Today the Bologna Process embraces 47 countries in the European Cultural Convention. The focus of this declaration is the higher educational system in Europe, vocational educations, and lifelong education. There are several aims of the Bologna process, where the most known is the development of the ECTS grade scale, comparable diplomas, mobility for students and a comparable grade structure. The main purpose could be shortened down to achieve comparable academic degrees in terms of quality and grading throughout Europe.

In this research the focus is on the comparable grade structure, known as the 3+2 system. The purpose is to grade the higher educational area in 3 year bachelor (both Bachelor of Science and Professional Bachelor), and a 2 year Master of Science (Dahlgren et al. 2009).

The current status is that the work is still in progress, and that the progression is different from country to country. The process has also had severe impact on the Danish higher education area. It is not within the scoop of this paper to describe the changes and impact thoroughly, instead a short “as is” description of the system is described in the following paragraph.

Short background on the educational framework

In general the educational level is high in Denmark (EACEA 2009). EHEA, a Bologna follow-up group secretariat, is leading the continuous change toward transparency in the higher education area. They also keep track on each country’s progress in the Bologna Scorecard. In the report from 2009 (Rauhvargers et al. 2009) Denmark is placed second, right after Scotland. Only implementation of the National Qualification Framework is not yet 100% in the Danish rating.

As mentioned, the implementation of the Bologna Process has created new ways of “moving around” in the Danish educational system, now allowing professional bachelor degree holders admission to Master of Science programs.

Brief introduction to the Cand.Scient.Techn. program

The students start at the the Cand.Scient.Techn. program at Aalborg University the 1st of February every year. The program is build-up of 4 semesters with four different topics. All 4 semesters are based on Problem-Based Learning principles, which implies: group work with real life construction cases, students identify and solve

problems in groups, teacher facilitates this process, interdisciplinary and practice based and students are active in class (Wandahl et al. 2008).

First semester has a 15 ECTS project where the topic is Project Design and design of construction sites. In addition 3 separate courses of 5 ECTS is mandatory. The courses are; Stressed concrete structures, Project management and economic, and Soil engineering. In addition students have to take a 2 week brush up course in applied mathematics.

Second semester has a project where the topic is Project management and production in the building sector and the three courses are: Building processes, Construction law and frameworks, and Development of quality and project management systems.

Third semester has a project where the topic is Management systems in construction companies and the three courses are; Development of advanced quality and project management systems, Strategy and performance measurements, and BIM.

The fourth and last semester has a 30 ECTS master thesis. Normally the students are working 2 or 3 students together on their thesis.

METHODOLOGY

With the purpose of evaluating the CST program, an electronic survey was conducted. The questionnaire was devised with outset in Forza's (2002) designing theory. The samples in this survey were past and current CST students, and in total 75 respondents were invited. 43 Answered, which results in a response rate of 57% which according to Malhotra and Grover (1998) is acceptable. The questionnaire was composed of four sections. First section entailed basic data such as age, gender, last educational, practical experience, and apprentice diploma. Second section concerned the enrolment process and asked why respondents applied, if they had enough information available for taking the decision, and what worries they might had prior to enrolment. Third section focused on structural, pedagogical and academic challenges because universities are another scale in all aspects compared to university colleges. Questions in this section were all open end questions, providing room for respondents to elaborate. The final section was only a single question, where respondents on a Likert scale should rate how well the education matched their expectations. A single question in section one was also based on the Likert scale. Questions in section two, on basic data, was factual information. All other questions were open end questions.

Data analysis was conducted in correspondence with the question type. When possible, correlation test are carried out, in some cases by converting answers to binary variables. Open end questions were analyzed by spotting trends. The preferred method was clouding, i.e. grouping of post-it on whit boards. Some answers can be hard to interpret because they were a bit off topic, but no answers were rejected.

To increase validity by means of triangulation, unstructured interviews with teachers were carried out. In total 6 unstructured interviews were conducted.

FINDINGS

Findings are grouped in three sections relative to the first three section of the questionnaire. Result of the fourth section of the questionnaire is described in the conclusion.

Background before enrolment

CST students seem to have a different background compare to MSc Students. Their age at enrolment is normal distributed with an average of 25,6 years, compared to MSC students average enrolment age of 24. 85% of the CST students are male and 15% are female. This is very similar to all technical programmes at Aalborg University.

98% of the respondents have a professional bachelor degree in form of an Architectural Technology and Construction Management diploma. This is very positive, since the purpose of the program was to enable exact this target group to obtain a master degree. It is also possible to enter the CST programme with a scientific bachelor, and with a variety of more or less relevant professional bachelor degree.

26% of the students have had relevant work experience in between their professional bachelor and entering the master programme. The amount of work experience is limited, approximately ½ to 1½ year. Employees have mainly been architects and consulting engineers. Moreover, only 30% of the students have had vocational training, i.e. an apprenticeship certificate. The remaining 70% have had upper secondary education before entering the professional bachelor. This is a little surprise, but reflects general society very well, i.e. high focus on young people getting a proper education. These 70% could probably have entered directly at the university (if achieved right qualifications in mathematics and physics), but choose not to. There are three reasons for not entering university directly. Firstly, the requested level in mathematics and physics is a barrier. This barrier also embraces the lack of interest in mathematics and logical analysis. Secondly, some students cannot oversee 5 years of study. It is simply too long, and does not reflect their current view on life. Thirdly, the social heritage is hard to overcome (Munk & Thomsen 2011). The main part of this group is grown up in non-academic homes. Hence they should be the first in the family to enter a university.

On their background it can be concluded, that the variance is high in terms of knowledge, competences, and skills. It is a large challenge for the university to take this variance into account. The university has no tradition in carrying out differential learning. What the teachers experience is that the university model with group work is essential for the students. They help each other, and together they manage to solve a "bigger" case than they could as individuals. The first semester of the CST program is specifically designed very flexible to cope with this variety in skills. For example students begin with a brush up course in applied mathematics. This course has no specific curriculum. The teacher only know what students must be able to do when finishing this course, and the teacher then aims at lifting the students as individuals to the target level independent on their starting point.

Several teachers have indicated that they have observed the abovementioned challenges, but they also mentioned that they are impressed of the students' practical knowledge in relation to construction. On teacher mentioned "*I contrast to most of our MSc students these CST do in fact know how to build a house.*"

Motivation for enrolment

When directly asked "Why did you enroll to the CST program?" the main answers are illustrated in table 1.

Why did you enroll to the program?	n	in % of N= 43
Own ambition of a master degree	22	51%
Hard to find job in economic down times	19	44%
Obtain management competencies	14	33%
The education looks interesting	11	26%
Differentiation from other when applying for jobs	10	23%

Table 1: Authors' interpretation of respondents' answers. The sum of n is higher than N because each respondent put forward several arguments.

There are three key points to observe. Firstly, more than 50% stated that they had a general quest for continuing their education. This CST program is one of the first, direct and most visible opportunities for professional bachelors with a degree in Architectural Technology and Construction Management. Secondly, the financial crisis is still slowing construction activity down, and therefore, fewer jobs are available. Several of the respondents answered that their first choice was to get a job, and the second choice was to get a master degree. This is confirmed by observations from the teachers, where it is noticed that approximately 20% of newly enrolled students quit the program within the first semester. Many of them due to job opportunities. Thirdly, 33% of the students aimed specifically at increasing their management knowledge. This is very positive, partly because the program was designed to give students construction management competencies, and partly because the construction industry often request labor with enhanced managerial skills.

Students did have different worries before enrolling. 28% of students had concerns about the mathematical level. Students with vocational training often have a low mathematical level, hence a chi-square test on these two binary variables is performed to find the probability of correlation between vocational diploma and concerns of mathematics. The calculation of chi-square, X^2, is 2.437, which with a freedom of 1 give gives a probability, p, for correlation of 0.11. This is not significant. In general students are worried about the overall level of a master degree compared to a professional bachelor degree. 26% expressed exact this worry. Several of the students had to move to a new city. Several of these expressed their concerns in terms of finding a place to live, moving away from girlfriend, find new friends, etc. Hence the social impact of enrolling is quite high. Since this is a new education 14% of the respondents expressed thoughts on how well the education is known by industry when they graduate. University strategy for meeting these worries was threefold. A website and brochures was created to inform about both content and social impact of studying at the university. Contacts to tutors were offered, both physical meetings and email and phone conversations. Finally, two of the teachers from the program were on a road trip visiting all of the Danish professional bachelor schools, hosting information meetings. This effort seems valuable, since 81% of the students found that they had plenty of information available to base their choice of enrolment on. Several of the respondents however comment upon that they found that the program was over sold in terms of management learning and indicates that information regarding the technical and mathematical level was restrained in brochures and at information meetings.

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Structural, pedagogical and scholarly challenges

Students were asked to respond to their perception of structural, pedagogical and scholarly challenges due to students' transition from professional bachelor to master program. Questions were developed as open end questions, which allowed respondents to elaborate their answers. In the data analysis, answers has been interpreted and grouped into observed tendencies. Most dominant is the students' evaluation of structural aspects of now being a university student. Several of the students respond that they find the auditorium teaching challenging. They were used to have class based teaching with around 20 to 30 students, which they all were familiar to. A large amount of the university courses is conducted in large auditoriums because 50-100 students follow a course. More over there is students at different level from different programs following a single course. A key challenge for many of the students in such an environment is the lack of opportunity to raise questions and discussion technical matters. This one-way teaching with afterwards assignments needs habituation. It also challenges the way these CST students is used to prepare and do homework. Many of the teachers point out that the have a perception of CST students not preparing satisfactory. In some courses this is validated through a very biased exam score. For instance, the average fail rate in project management and economics is around 10%, but for CST students the rate has raised to around 50%. CST students are also astonished of the effort put into written work and assignments, and the need level for passing. This paramount focus on the writing abilities is new for the CST students. Finally, Aalborg University practices problem based group work, and many of these new students have trouble coping with group dynamics. It is new that they themselves have to found groups and also handle conflicts within a group. Some points out that this raises a kind of competition among groups, which is not the intention. Groups should foster mutual sharing of knowledge and resources which is found natural among other MSc students, but seems not to foster among the CST groups. It is also pointed out that several of the respondents find groups to be more isolating. They were used to have 20 to 30 "friends" in a class, now they only have 4 to 5 "friends" in their group.

Combining these three structural challenges several of the respondents rate the study environment as less attractive here at university than at their professional bachelor programs. This is a surprise for the university in general, because Aalborg University often promotes the great study environment (though comparable to other universities). Hence, there is room for easing transfer issues for these CST students, both regards to what the university can expect from prospect students and regards to how to better inform and prepare prospect students prior to enrolment. In general the transition process can be improved. Several helping guidelines were suggested by respondents. The information flow up to and during the beginning of the first semester should be more intense. Even though there is assigned a coordinator to each enrolment class, this seems to be insufficient. Some respondents write that they have a feeling of being misunderstood by "the university system" and that too little effort is put into knowing and understanding the basis that these students bring into the university. A few respondents describe situations among other students and teachers where they have felt condescending comments aimed at their workman background. This is inappropriate and unnecessary. A teacher stated that now after supervising more than 5 CST students during their final thesis he is convinced that these CST students is equal to traditional MSc engineering students, in terms of analytic and academic skills as well as in their ability to foresee new and improved construction management

solutions. In relation to the poor study environment the foundation for improving this lies in transition process.

Academic challenges in general are also commented upon, and a few general trends are observed. Teaching as well as project work is much more theoretical than the main part of the respondents is used to. Now students must know not only know how to do e.g. scheduling, but also why. This forces another challenges of homework. The workload is much higher than what they are used to. When textbook and sometimes classes is in English language some of these CST students find it very hard and time consuming.

Respondents were asked to point out what have been the most challenging in relation to their education. 36% pointed at the course in soil engineering on 1. semester. 20% thought the course in stressed concrete structures, also on 1. Semester, were the toughest. An obvious trend that the 1. Semester in general is the most challenging is evident. The remaining respondents pointed at a variety of courses, and only one respondent did not point out a course, but instead mentioned report writing as the most challenging of the program. As mentioned earlier, teachers have a perception of that student entering through vocational training have more trouble with mathematics than their peers. Correlation between vocational training and pointing out mathematics as the most challenging is calculated with a chi-square test. The calculation of chi-square, X^2, is 8.66, which with a freedom of 1 give gives a probability, p, for correlation of 0.0035. This is significant.

Finally, the academic level was also assessed by the respondents. The assessment should cover all semesters and all courses. 22% answered low, 34% medium and 27% high, and finally 17% very high. This results in a slightly right skew normal distribution.

FUTURE DEVELOPMENT

Due to among others this research some changes has been implemented in the CST program. It is in general the 1. semester that have changed. The course in soil engineering has been eased and given a slightly different focus. Now this course is named Foundations and soil loads. The course in stressed concrete structures is deleted along with the brush up course in applied mathematics. Instead a new course in fundamental statistics and Problem-Based Learning is offered. In total this is lowering the request for mathematical skills and increases the focus on structural changes and conditions for now doing academic work at universities.

CONCLUSION

When concluding on the success of developing a master education that enables holders of apprenticeship certificate, two important elements surfaces. Firstly, only one third of enrolled students have in fact an apprenticeship certificate. Two third enters with an upper secondary education. Secondly, data analysis clearly show that the one third are slightly more satisfied with the education with an average score of 8,25 on a scale from 1 to 10 (best). The lowest score appointed is 7. The remaining two third has an average score of 7,3 ranging from 2 to 10. It is clear that some of these students are in fact disappointed with the education. Now to classes has entered the job market, and this in times where construction activity still is low. Nonetheless, 80% of the first class were in job after 6 months. This is a great success, but still a bit

below average seen over the last 10 years of MScs entering the job market. Hence, it seems that the construction industry not is 'afraid' of the new Cand.Scient.Techn. title.

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INTEGRATING STUDY ABROAD OPPORTUNITIES INTO A CONSTRUCTION MANAGEMENT CURRICULUM

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ABSTRACT

Many universities in the United States have recently emphasized international education as part of their core education mission, recognizing that increasing the global competence among the next generation is a national priority and an academic responsibility. One way to achieve this goal is to implement study abroad education into the construction curriculum. Therefore, in 2001, a few faculty members proposed the unconventional idea of a senior-level Study Abroad Thesis class for the Building Science undergraduate program. This idea became the first faculty-led study abroad class, among the 130 accredited construction programs in the Associated Schools of Construction, that involved an undergraduate research thesis. This class has been offered 10 times since 2002 and students have travelled throughout Western Europe and China as part of the 5-week data gathering component of the class. All students completed their Thesis research and graduated on time or ahead of schedule. Over a dozen student Theses have been co-authored with faculty and published in International conference proceedings or journals.

Keywords: construction education, experiential-learning, service-learning, study abroad,

INTRODUCTION

Evolving world-wide construction markets dictate that American building science students should possess an awareness of the built environment and cultural issues in a more *global* context. One way to achieve this goal is to implement study abroad education into the construction curriculum. Many academic disciplines outside of construction education (e.g. foreign languages, art, music, architecture, etc.) have successfully used study abroad programs as an effective means of broadening university students' academic, personal, professional, and cultural views of the world (NAFSA, 2012; Rebholz, 2000). Therefore, in 2001, a few faculty members proposed the unconventional idea of a senior-level *Study Abroad Thesis* class for the Building Science undergraduate program. This idea became the first faculty-led study abroad class, among the 130 accredited construction programs in the Associated Schools of Construction, that involved an undergraduate research thesis. This class is unique in construction education because of: (1) the multi-city traveling component, (2) the student's written research-based thesis with faculty jury presentation, (3) the required

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cultural events, and (4) the implementation of *experiential learning* through student-initiated research visits to foreign design and construction firms. The course design and implementation has evolved during the past 10 years and may be of interest to other construction faculty. Also, two additional study abroad opportunities for building science students will be discussed, along with their respective course design and learning outcomes.

UNDERGRADUATE RESEARCH THESIS CLASS ABROAD

The summer Study Abroad class consists of two parts: (1) a 5-week data gathering component while students travel throughout Western Europe or China, (2) a 5-week in-residence class work component, in Auburn, writing and defending the Thesis. Also, the summer Study Abroad class actually consists of two separate required Building Science (BSCI) classes. The first is the research-based *Study Abroad Thesis* class (4 credits) and the second is the *Temporary Structures in Construction* class (2 credits). By offering these two courses together, the senior students can graduate 1 semester early and complete their required senior capstone project during the 10-week summer semester, rather than the following fall semester as the cohort-based curriculum dictates. Typically the class size is between 10 to 20 students and is usually comprised of undergraduate Thesis students, but often graduate students participate and enroll in electives classes that satisfy their coursework requirements. Auburn University requires that two faculty members travel with the class and all students and faculty maintain medical insurance through MedEX.

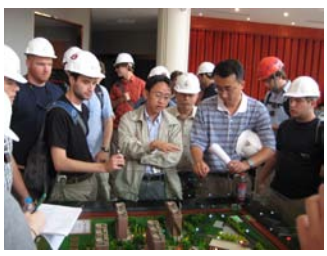
Class Itinerary and Preparation

In addition to the summer study abroad class, all students are required to participate in a 2-credit study abroad preparation class offered during the preceding spring semester. The preparation class is designed to be interactive on many levels. The students participate in developing the course itinerary for the summer and select their thesis research topics to compliment the scheduled events in each of the cities visited. During the course itinerary phase, students are responsible for contacting the construction firms, material suppliers, and equipment manufacturers in cities that will support their research topics. Through this process, the itinerary is continuously revised to include construction visits that the students arrange. Other scheduled construction-related visits are arranged by the professor in charge of the class, in addition to arranging the cultural events for each city.

A high priority is placed on relating the students' research topics with the study abroad construction visits. This enables the students to collect data for their thesis research topics (e.g. sustainable design, green construction, project delivery methods, and craft worker training) as part of the visit (see Figure 1).

Figure 1.

"Bird's Nest", Beijing



Green Design, Shanghai

Sustainable Design, Shanghai

Study Abroad Cost

In an effort to promote study abroad at Auburn University, new administration guidelines concerning faculty-led classes have allowed the Building Science program costs to be much more attractive to prospective students. Effective 1/1/04, Auburn University students **DO NOT** have to pay university tuition in addition to the study abroad program costs. The students are required to pay only the $540 Office of International Programs fee, in addition to the direct costs of the study abroad class. This new policy helps defray the cost of the class for in-state students, but for out-of-state students paying triple in-state tuition, the cost of the study abroad class is typically the same as staying in Auburn, Alabama.

Learning Objectives and Class Organization

The overall learning objective of the class is *to expose students to construction-specific companies, projects, practices, and project management professionals that they would never be exposed to otherwise*. There are typically three construction-related visits per city (e.g. construction projects, material suppliers, construction firms, equipment manufacturers, etc.). Some of the past visits include: marble quarries in Carrara, Italy, concrete pump manufacturers in southern Germany, curtainwall manufacturers in Munich, renovation of the U.S. embassy in Rome, and renovation of the War Cabinet Rooms in London (see Figure 2).

Figure 2.

London – Skanska project

London – Bovis Lend Lease project

Students with U.K. War Cabinet Secretary – Bovis Lend Lease

Putzmeister PUMI, concrete ready mix truck & pump combined, Munich

The students collect original source documents (e.g. transcribed interviews with key executives, photos, company brochures, company training material, videos of visits, etc.) during the 5-week traveling half of the 10-week summer semester. Also, there is typically one cultural event per city (e.g. ballet, opera, concert, musical, etc.).

After returning from Europe or China, the second 5 weeks of the summer semester is dedicated to organizing and synthesizing the data acquired while travelling and writing the research Thesis. Students are required to write an original research paper, using the ASC Journal style guidelines (ASC, 2012), in the range of 40 – 60 pages excluding copies of original source documents, appendices, and references. In addition, the students are required to create a 30-minute PowerPoint presentation that

is presented and defended to a jury of Building Science faculty. The student's grade is typically based 75% on the written paper and 25% on the PowerPoint presentation.

Travel Blogs

In recent years, family members and friends have been concerned about staying in touch and following the groups' travels abroad during the summer semester. While email and cell phones are an important way of staying in touch, it does not offer a shared discussion environment that would serve as a travel journal or blog for the students' experiences. After exploring options of web blogs, travel blogs, newsgroups and Wikis, a WebCT™ (WebCT, 2004) site was developed in 2004 and other travel blogs have been used since 2008. See www.aubsci.org (Europe) and www.bsci2012sadu.blogspot.com (Australia/New Zealand) as examples of recent class blogs for 2012.

Students are typically assigned the task of posting a thoughtful and substantive reflection of some aspect of their visit to each city. They are also required to post a response to a classmate's posting for each city. These reflections are accompanied by digital photos uploaded and attached to the discussion posting. This provides for an online exchange of concepts learned among faculty and students while traveling, which is also shared with others back home.

Faculty Involvement

In order to ensure the future success of the class, in 2003 Professor Kramer developed a mentoring program where he acted as the lead-faculty mentor and Professor Hein was the faculty-in-training. This allowed Professor Hein to gain knowledge of the study abroad planning aspects and understand the academic requirements for the thesis research. During the summer 2005 class, Professor Hein graduated to faculty mentor and Professor Murphy was the faculty-in-training. This mentoring process has been very successful and has allowed different Building Science faculty to participate in the study abroad thesis class and to ensure its continuation (see Table 1).

Table 1.

Year	Study Abroad Thesis Leader	Faculty-in-Training
2002	Scott Kramer	None
2004	Scott Kramer	Michael Hein
2005	Michael Hein	John Murphy
2006	John Murphy	Anoop Sattineni & Peter Weiss
2007	Anoop Sattineni	Linda Ruth & Bruce Smith
2008	Linda Ruth	Michael Hein & Paul Holley
2009	Scott Kramer & Bruce Smith	Junshan Liu & Peter Weiss
2010	Scott Kramer & Junshan Liu	None
2010	Anoop Sattineni	Salman Azhar
2011	Paul Holley	Mouton, Farrow & Tatum
2012	Anoop Sattineni	Scott Kramer & Mark Tatum
2013	Salman Azhar	Michael Hein & Junshan Liu

SHORT TERM SERVICE-LEARNING CLASS ABROAD

As the Chinese proverb explains, "I hear and I forget. I see and I remember. I do and I understand" (Stewart et al., 1994). Service-learning favors *engagement* over *exposure* in order to make the trip a more rich experience instead of a nondescript field trip. It helps students retain the knowledge garnered from the educational investment (Tinker and Tramel, 2002). Service-learning trips are an opportunity for students who are inexperienced in the field to gain much-needed hands-on practice in a low pressure situation (Stewart et al., 1994). In addition, successfully using their skills to provide for an immediate need bolsters students' self-perception of their capability (Layer and Gwaltney, 2009).

The experience also enhances students' ability to communicate effectively — particularly with the client who is at hand in most service-learning situations (Aidoo and Sexton, 2008). Researchers at one institution noted that they had not anticipated the outcome of a strong camaraderie and collaboration as a result of the trip. Students developed their leadership and teamwork abilities and were able to synthesize information and solve problems with their peers (Stewart et al., 1994). Finally, service-learning trips foster a unique dynamic between faculty and students that typically does not occur in a traditional classroom setting. Working alongside one another, students develop a greater respect for professors and professors a friendship with the students (Tinker and Tramel, 2002).

Quito, Ecuador – Collaboration between SIFAT, Building Science and Nursing

Building on the school's previous study abroad experiences, two Building Science (BSCI) faculty members planned and implemented a 10-day service-learning trip to Quito, Ecuador during the spring semesters of 2010 and 2012. They offered the trip in hopes that it would appeal to students who would not have otherwise been able to study abroad. In order to minimize a common barrier to study abroad participation – cost, they limited the fee to $2,200 and traveled during Spring Break. Class credit was not offered in 2010, but in 2012 the trip was included in a required 2-credit BSCI class, *Temporary Structures in Construction*.

The 2010 group of 6 students and 2 faculty, consisted of undergraduate and graduate students from the McWhorter School of Building Science as well as 17 senior-level School of Nursing (SON) students and 4 nursing faculty. The nursing students set up a temporary women's clinic as part of their required 120-hour preceptorship class. In 2012, there were 8 BSCI students and 12 SON students plus 2 BSCI faculty and 3 SON faculty.

Both collaborative trips were coordinated through Servants in Faith and Appropriate Technology (SIFAT) a non-profit organization headquartered in Lineville, Alabama. SIFAT is a faith-based group that promotes holistic development in South America and Africa. They maintain offices and full-time staff of nationals in both Bolivia and Ecuador and seek to support sustainable self-help among needy populations.

Class Construction Project

The BSCI students worked on an on-going construction project called Dulce Refúgio, an after school care center for underprivileged children. The project will be built in two phases over the course of several years as funds and volunteer labor become available. The first phase involves the construction of a 4-story, 30,000-sf children's center which is being built on an urban site adjacent to an existing church building. The concrete structure will serve approximately 300 children. The second phase calls for the eventual demolition and re-construction of the church building.

The BSCI students and faculty members worked Monday – Friday, 8:00 am – 4:00 pm at the construction site. During this time, they formed and placed a grade beam (Figure 3) and four round columns (Figure 4). The group practiced many means and methods foreign to the students which included building round column forms from scrap tongue-and-grove floor boards (Figure 5), hand tying all rebar cages, and mixing concrete by hand directly on a flat concrete slab (Figure 6) with shovels. The team had the opportunity to work alongside the Ecuadorian nationals. Two craftsmen, an engineer, and the pastor of the church directed the construction process, and though they were initially skeptical of the North Americans' ability, they formed strong working relationships of mutual respect by the end of the week.

Figure 3: Grade Beam

Figure 4: Column Rebar

Figure 5: Column Forms

Figure 6: Mixing Concrete

Exhausted from the laborious tasks and the extreme altitude (9,500 ft.), the BSCI team typically ended their day late in the afternoon and embarked on numerous cultural excursions throughout the city. Students had the opportunity to stand on the equator at the *Middle of the Earth* and to climb the highest spires of the Basilica del Voto Nacional which has been under construction for 123 years. The group also rode the Teleferico, a gondola which transverses 3,000 feet to an altitude of 13,000 feet above sea level and offers an unparalleled view of the city. For another side trip, students traveled to a nearby rainforest for a zip-line ecology tour. Additionally, they experienced Ecuadorian culture by touring various open air markets, local hardware stores, and eating traditional Ecuadorian dishes. Perhaps the most rewarding experience, however, was interacting with the center's children in a North Americans vs. South Americans soccer match, which the children won handedly. All of the

activities provided invaluable insight to the lives of the construction project's future occupants and owners.

STUDENT EXCHANGE SEMESTER ABROAD

Even though the McWhorter School of Building Science has been a leader among the Associated Schools of Construction (ASC) in the area of faculty-led study abroad classes, the school does not currently have any semester-length student exchange programs with universities outside the United States. This deficiency will soon be corrected with the establishment of an exchange program between Auburn University and Hong Kong Polytechnic University.

This study abroad student exchange program will be designed to explore the built environment in Hong Kong and other Asian cities. Students will be exposed to some of the world's most modern and advanced works of Architecture, Engineering and Construction. Our aim is to allow Building Science (BSCI) students to study, in an academic residence, a variety of construction materials, methods, and technologies commonly used in Asia within the cultural context of living and studying in Hong Kong. This program will be offered once every year starting in 2014. The duration of the student exchange program will be one semester, preferably spring semester January – May and the target date for implementation is scheduled for spring, 2014.

BSCI students are accepted into the professional program as a cohort of 30 students at the beginning of their junior year of study (5th semester). Each semester, (Summer, Fall, Spring) only 30 students are admitted into the program. However, a double section of 30 students (60 total) are admitted into the spring semester every year. Therefore, the optimal time for BSCI students to study in residence at Hong Kong Polytechnic University (HK Poly) will be the 7th semester of their plan of study. The initial exchange program will be marketed to the 60-student spring semester cohort class. In this way, the students' 7th semester of study (shown in Table 2) will be a spring semester which aligns with the academic calendar of HK Poly.

Table 2.

BSCI 4750 Electrical Systems in Buildings	3 hrs
BSCI 4600 Project Controls III	4 hrs
BSCI 4601 Project Controls III CIT Lab	1 hr
BSCI 4800 Contracting Business	4 hrs
BSCI Construction Science Elective	3 hrs
Total	**15 hrs**

The overall goal is to allow the Auburn student to graduate on time even though they had the opportunity to study a full semester in a totally different culture and environment.

CONCLUSIONS

The overall goal of every BSCI faculty-led study abroad class is to *expose* students to companies, projects, materials, methods, equipment, and construction professionals that they would never be exposed to otherwise. Another major goal of every class is

to *expand* the students' academic, professional, and personal views of the world from regional to global.

The Building Science faculty is firmly convinced that study abroad courses add tremendous value to the educational experience of not only the students who participate, but to our entire construction management program in general. Interaction with the participating students after they return to Auburn stimulates even more interest among lower-level students and faculty members each time. Prospective students and their parents often ask about the details of the study abroad classes when making campus visits. The success of our study abroad classes gives our students a real-world global perspective that would be hard to obtain otherwise.

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LEGAL TOPICS IN THE BACCALAUREATE DEGREE

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ABSTRACT

A review of descriptions of legal and contract courses offered by ASC member and ACCE accredited CM baccalaureate programs was performed. Overall, the course descriptions were found to fall short of demonstrating compliance with ACCE accreditation requirements. Potential explanations for this deficit include course descriptions written in general terms and actual non-compliance with the ACCE requirements. While Construction Law and Contracts were covered by nearly one half of the programs reviewed, more than 80% of the programs failed to display compliance with the remaining legal requirements. The dominant conclusion of this study is the need for the decision makers of the construction industry, institutions of higher learning, and accreditation bureaus to work together not only in development of strong CM programs but also clear indications of topics included in the curricula.

Keywords: accreditation, baccalaureate, contract, law, legal.

INTRODUCTION

New graduates with a baccalaureate degree in Construction Management are expected to be able to manage the day to day activities of a construction project often with the responsibility and authority of a Project Manager. Throughout their college career these graduates studied topics including Planning and Scheduling, Estimating, Materials and Equipment, Soils, MEP and a plethora of other topics. Many schools also include a requirement for students to take a class or two in Business Management where contract theory, negotiation, and ethical behavior are discussed. With this all-around exposure to topics and concepts the students, now graduates are presumed to be ready for an assignment in Project Management. However, observation of the graduates' on the job performance too often reveals an apparent lack of readiness. The survey performed as the basis of this paper supports that observation and indicates that the students have not received the necessary training required to fulfill these expectations, particularly with respect to legal topics.

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The intent of this study was to make a preliminary determination of the clearly covered topics included in the curriculum of the baccalaureate degree in Construction Management. Of specific interest are those topics associated with construction law. Given that the number of Construction Management programs available in this country alone is quite numerous some selection filters were applied. Specifically, to be included in this review a CM program was considered only at the Baccalaureate level, must have been accredited by the American Council for Construction Education (ACCE), and must be a member of the Associated Schools of Construction (ASC).

ACCE accreditation was deemed necessary as those are the requirements against which each program was to be characterized. Additionally, membership in ASC was set as a criterion by presuming that a program with ASC membership would take seriously the need to fully educate its students. It should be noted that these selection filters excluded programs that are ABET accredited rather than ACCE. The omission of these programs should not be taken as an indication of deemed lesser qualifications rather simply that we desired an initial study pool of controlled size. After sorting the rosters of associated programs in both groups a total of 63 programs were identified for review.

ACCE accreditation requirements

The ACCE document entitled *Standards and Accreditation of Postsecondary Construction Education Degree Programs* published in 2011 was found on the ACCE webpage at www.acce-hq.org Review of this document showed the subject matter items listed below are required to be offered by a CM program to receive accreditation by ACCE.

- Oral and Written Communication
- Physical Science and Mathematics
- Economics, Principles of Management, Accounting, and Business Law
- Design Theory, Construction Systems, Construction Methods and Materials, Construction Graphics, and Construction Surveying
- Estimating, Planning and Scheduling, Construction Accounting and Finance, Construction Law, Safety, and Project Management

The ACCE document also provided greater detail of requirements for certain fields. The detail requirements included under Construction Law, and thus, the topic of this study, are:

- Construction Contracts, Roles & Responsibilities of Parties
- The Regulatory Environment and Licensing
- Lien Laws and the Contractor's Rights
- National and Local Labor Law
- Administrative procedures to Avoid Disputes

The plan for implementation of the survey was to review the website for each of the 63 selected programs and identify how many of the programs met each of the criteria.

Course descriptions vs. requirements

The curriculum of each program was reviewed for required class titles that appeared to include any or all of the topics on the list. Then, the descriptions of these courses were entered into a spreadsheet for detailed review. The detailed information was far

easier to find on some websites than others and ultimately there were 19 programs for which no course descriptions could be found.

The data collected from the website of each program was used to gauge conformance with the ACCE requirements; no comparisons or ranking of programs was made and no challenge of the ACCE accreditation should be inferred.

Table 1 lists the ACCE requirements and the number of programs that indicated conformance based upon a word search of the course descriptions.

Table 1

ACCE Topic	**No. of Programs***
Construction Law	19
Construction Contracts	20
Roles & Responsibilities	8
Regulatory Environment & Licensing	3
Lien Laws & Contractor's Rights	7
National and Local Labor Law	5
Administrative Procedures to Avoid Disputes	16

**No Course Descriptions were found for 19 of 63 programs*

Even though no information could be found for course descriptions in 19 of the 63 programs it was anticipated that the search results for each area would have been closer to the 44 identified programs with information available.

In anticipation that the text of the description conveyed intent of class coverage without using the exact words stated by ACCE each course description was independently reviewed and counted against each topic in accordance with the understood intent of the course. The results of the revised count are shown in Table 2.

Table 2

ACCE Topic	**No. of Programs**
Construction Law	27
Construction Contracts	28
Roles & Responsibilities	17
Regulatory Environment & Licensing	4
Lien Laws & Contractor's Rights	8
National and Local Labor Law	5
Administrative Procedures to Avoid Disputes	24

Although the results of the revised review were improved, they still fell far short of anticipated findings. The findings regarding the first three listed topics, considered vital for the success of the construction industry, are discussed in the following section.

Discussion of findings

The topics of Construction Law, Construction Contracts, and Administrative Procedures offer the best correlation with the terms included in the ACCE requirements. This should come as no surprise given the nearly daily requirement for

a PM to refer to the contract, plans, and/or specifications to resolve some question at hand. What may be surprising is the apparent lack of total compliance. For the most part, this shortage is a result of a classification decision used in the study. Many CM programs seem to partner with Business School classes for the coverage of Contract Law. Programs that did so were not given credit for compliance with this item. The basis for this choice is the difference between construction management and business management. While contracts in both arenas certainly have the same basics such as agreement, offer/counter-offer, and consideration, construction contracts also include numerous additional topics including schedule, unit pricing, change procedures and retention. Since a qualified PM must understand all of these topics, and more, compliance credit was given only for courses specifically covering Construction law, contracts, and administrative procedures.

Compliance in the area of Roles and Responsibilities is surprisingly low; particularly when one considers the number of different players involved in a construction project and the varying levels of authority of personnel representing the involved companies. Imagine the new PM going out to the project site believing that it is his job to assure that all the work is being performed properly. In its simplest interpretation certainly not a difficult task to understand. Now imagine that same PM while viewing the progress runs across a junior member of the design team who is in the field to measure work completed. The two begin to talk and the junior designer mentions that the sidewalks the contractor is setting formwork for should be 5' wide not 4' as they are currently doing. Of course our PM checks his plans and sees that they call for 4' wide sidewalk but, not having studied roles and responsibilities in school, believes it to be his duty to follow the intent of the designer and instruct the contractor to revise the width of the sidewalks. Innocent mistakes, even made with the best of intentions, are still costly.

The survey shows an amazingly poor compliance in the areas of Regulatory Environment, Licensing, Lien Laws, Contractor's Rights, and Labor Laws. Many CM programs cover these topics but only at the graduate level so those results were not included in this count. It may be argued that these topics vary by State and thus too broad too cover. However, the basics remain the same and in accordance with the ACCE requirements should be covered.

CONCLUSIONS & RECOMMENDATIONS

ACCE requirements for accreditation of a baccalaureate program in Construction Management are quite clear and comprehensive. Questions arise however, when the course descriptions at different learning institutions are reviewed. While the institution may have ACCE accreditation, compliance with the requirements is not always readily apparent. Now, while the programs are growing and evolving, is the time for industry, schools, and accreditation bureaus to work together to develop the strongest possible programs and generate clear descriptions of topics included.

Having reviewed the results of the survey and considered some of the potential risks in not covering the identified topics some recommendations for improved compliance and performance may be made.

With all of the discussion presented thus far, one obvious point has not been mentioned: that course descriptions may be written in a general fashion and do not

specify each topic included within the course. ACCE has stipulated topics that must be included in a curriculum for that program of study to become accredited. The average member of the construction industry probably does not know the ACCE requirements for accreditation by rote. Course descriptions need to be specific about the concepts included. This would not only give the potential student a better idea of what they will be studying but will also let industry know the specific topics covered in the program.

Some of the concepts included in discussions of law, regulation, and contracts are deeper and more involved than those generally found at the undergraduate level. Perhaps it would be of benefit to industry, CM programs, ACCE, and students to revisit these requirements. To be effective, a PM must certainly understand the basic concepts of construction law and contracts; conceivably, decision makers in the construction industry could provide input to ACCE regarding their priorities of needs and expectations of a CM education in general and specifically legal aspects.

Degree programs in Construction Management are still relatively new. Many colleges and universities are still struggling to decide where best to house the CM program. While it is certainly difficult going through the growth and development of the programs now is an opportune time to make enhancements to the curricula. One such modification might be to require students to work in the field for a stipulated period of time. Whether a sponsored internship or simple summer job the field exposure would offer the student not only confirmation of lessons learned but also the importance of the required legal concepts. Of course there are countless opportunities to enhance a CM curriculum but the changes need to be made in a controlled manner to assure continuity of the requirements.

Finally, this study did not consider ABET accredited CM programs; however, such a study would certainly be beneficial. The construction industry as a whole needs assurance that a graduate with a baccalaureate degree in Construction Management has the same basic knowledge regardless of the school of study. ABET and ACCE accreditation requirements should be reviewed and compared; perhaps melding the two would result in the ultimate CM program.

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NON-PAYMENT BY EMPLOYERS TO SMALL AND MEDIUM CONTRACTORS: CONTRACTUAL REMEDIES

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ABSTRACT

The effects of late or non-payments have been felt more particularly by small and medium-sized contractors and consultants, causing these contractors and consultants severe cash flow problems and affecting their performance negatively. When faced with a situation of late or non-payment, the only reaction or remedy is to consider stopping the work on site. From a South African perspective, a recent case study proposes some remedies which contractors may use when confronted with late or non-payment. The findings of this study will assist the small and medium-sized contractors to understand their position before they can take any action when employers fail to make payment or effect late payment to contractors. The rights and obligations of the contracting parties are therefore examined and solutions will be proposed.

Keywords: Non-payments, employers, building industry, contractors.

INTRODUCTION

The sustainable development in the construction industry is one of the prerequisites for the sustainable development of the South African economy as a whole. If the construction industry becomes uncompetitive, it will make all private investment in capital assets unattractive. It will also restrict improvements in general infrastructure. The industry remains a major source of employment creation and is therefore both a means and a method of facilitating development.

> "*Poor payment practices in the construction industry give rise to substantial additional financing and transaction costs. More importantly, certainty over how much and when payment is made builds trust between supply team members and underpins collaborative working to achieve value for money projects for clients."*

In a stable environment, a construction business requires very limited permanent capital to start or operate. Construction projects are largely financed through interim or monthly payments that fund the next stage or period of work. Capital requirements are restricted to the spread in cash flow between payments and receipts.

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According to Buys (2006), the biggest problem faced by the construction industry in South Africa is the problem of late payments by clients and this situation leads to disputes that end up being treated as routine maintenance.

WHAT DOES PAYMENT MEAN

Payment means the money given or to be given to a person in return for the goods sold or services rendered. In construction, payment is defined as "a monetary consideration for the contractor's performance or work done" (Judi & Rashid, 2010). In *Royden (M) Sdn Bhd v Pembenaan Yeah Tiong Lay Sdn Bhd*, payment was defined as "the value of any work, materials or goods comprised in the contract.". In other words, payment is the consideration, in terms of money, for the work that a contractor has carried out in accordance with the contract plus the materials delivered to site. Contractually, the said money must be paid promptly and fully unless there are specific reasons for delaying or withholding it (Judi & Rashid, 2010).

In the past a number of different authors examined the problems related to non/late payments to contractors both in South Africa and abroad.

REFERENCE TO THE MARX REPORT (2009) AN OVERVIEW

The Marx report indicated that, in payment delays experienced by contractors for the years 2004 to 2007, there was a decrease from 24% to 9% in the number of all projects where payments were made timely within 14 days, if the 2004 results are compared with the 2007 results. In 2007 the private sector clients were the worst early payers, with payments made within 30 days on only 35% of their projects. Public private partnerships were the best performing clients with 59% and 56% respectively. There was an increase in projects with payment that took more than 30 days from 43% in 2004 to 56% in 2007. At least there was a reduction in percentage that was 120 days by 13% in 2004 to 3% in 2007 (Marx, 2009; Maritz & Robertson, 2010).

REFERENCE TO THE MASTER BUILDERS SOUTH AFRICA DRAFT REPORT 2009

In response to the Marx report, master builders have conducted their own research and their findings were summarised as follows:

Nationally, across all clients, (all projects included in the survey), 54% of projects were paid within 30 days; 26% between 31 and 60 days; 13% between 61-90 days; 3% between 91 and 120 days and 4% more than 120 days.

National government and the private sector seem to have the best record with 85% and 79% of payments made within 30 days and the 15% of national government was paid between 31 and 60 days (Maritz & Robertson, 2010).

Local and provincial government payments were only effected between 31 and 60 days after invoicing (45% and 44% respectively) with only 38% and 23% payments made within 30 days from date of invoice and 15% of local government projects paid between 90 and 120 days after date of invoice.

In South Africa specifically the *Public Finance Management Act*, Act 1 of 1999 stipulates that payment should be made within 30 days of submission of a valid claim. It appears that many employers do not comply with this legislation or the terms of contracts signed between the parties.

THE CONSTRUCTION INDUSTRY DEVELOPMENT BOARD INDICATORS

The Construction Industry Development Board (2009) publication was summarised as follows: In the survey related to contractor payments, completed in 2009, it was revealed that 42% of payments were made within 30 days of submission of a claim; 48% was paid between 30 and 90 days; and 9% was paid after 90 days. It was also recorded that 47% of clients' agents were paid within 30 days after submitting a valid invoice, whereas 46% were only paid between 30 and 90 days; 7% were paid over 90 days. Refer to Table 1 below for outstanding fees for more than 90 days.

Income distribution	**Jan-Jun 2007**	**July-Dec 2007**	**Jan-Jun 2008**	**July-Dec 2008**	**Jan-Jun 2009**	**Fee income outstanding longer than 90 days R million, current price**
Central Government	4.8	10.4	5.3	3.9	7.3	R53
Provincial Government	5.7	5.4	5.8	4.3	3.8	R132
Local Government	6.9	8.3	10.5	6.9	13.2	R419
State-owned Enterprises	3.2	5.9	5.8	7.7	1.4	R15
Private Sector	9.9	8.6	9.6	11	11.9	R801
Foreign	29.2	42	17.5	27	13	R136
Total	**10.3**	**11.3**	**11.1**	**12**	**9.5**	**R1 557**

Table 1: Fee income outstanding for 90 days or more (including foreign fees)

Source: cidb, 2010 practice notes

Hasmori MF, Ismail I & Said I. 2012. "Issues of late and Non-payment among contractors in Malaysia"

According to Hasmori, Isamail and Said (2012) the major factor leading to a successful project is the practice of efficient and timely payment in construction projects. In their study the following were extracted and summarised as follows:

There are numerous factors that cause late or non-payment and the majority of them involve clients, developers, contractors and contractual matters. Reeves (2003) as cited in Hasmori, *et al.*, (2012) states that the main reasons for late payment are errors that occur in submitting claims. This includes claims without adequate supporting documents, incorrectly calculated claims and those submitted without following the right procedure. Some other important reasons indicated in this study were contractors failing to agree with the valuation of work on site; payment being wrongfully withheld by clients or client representatives (Ismail & Said, 2012). According to Rahman, Wang, Takim and Wong (2011), late payments are defined as failure by a paymaster to pay within the period stipulated in the schedule of contract. Furthermore, they argue that cash flow management is to avoid extended cash shortages as a result of having too great gaps between cash inflows and outflows.

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CONTRACTUAL REMEDIES

Suspension Of Work

According to Judi and Rashid (2010), a contractor is entitled to suspend the works on site following any late or non-payment if such a term is expressly stated in the contract. But when one examines the general principles of common law, the contractor has no legal right to suspend the work; nor does the employer have a legal right to order its suspension. Once the contract work has commenced, it is the contractor's obligation to carry out the work in a regular and diligently manner until it is completed. As a result, unjustified suspension by either party will amount to a breach of contract for which damages may be claimed. However, in common law a contractor has a right to suspend work as long as the damage is not sufficiently serious to become a fundamental breach. In the United Kingdom, section 112 of the *Housing Grant Construction Regeneration Act* (HGCRA) provides that when the sum is not paid on the final day of payment and no withholding notice has been issued by the employer, then the contractor is entitled to suspend his performance until the full payment is settled.

Slowing Down The Works

Furthermore, Judy, *et al*. (2010), indicates that in the Malaysian construction industry the contractor has no legal right to slow down the works for reasons of late or non-payment, unless of course it is clearly stipulated in the contract.

Claim For Interest On Late Payments

In the South African context, the JOINT BUILDING CONTRACT COMMITTEE (JBCC) principle agreement clause 31.11, where the contractor does not receive payment of the amount due by the due date, the employer shall be liable for default interest on the amount without prejudice to any other rights the contractor may have. Such interest amount shall be compounded monthly from due date for payment up to and including the date on which the contractor is to receive payment and included in the recovery statement. The principle agent shall calculate such default interest at the rate of one hundred and sixty per cent (160%) of the interest. Mvubu and Thwala (2008) in their study argues that contractor must have a credit relationship with suppliers but, if they receive their payments late, this relationship will be destroyed and the supplier will charge interest from the contractor which he did not receive from the client.

Termination Of Contract

For most construction contracts, payment within the contractually agreed framework is not specified to be "of the essence" and therefore a failure to make payment would not be a breach that goes to the root of the contract. Under the law of contract, failure to pay on time what is due will not be treated as a sufficient breach to justify the other party's terminating the contract.

METHODOLOGY

A post-positivist paradigm was applied to evaluate the effects of late or non-payment by clients to contractors and consultants in the building industry. 31 questionnaires were hand delivered to industry professionals and consultants around the Free State Province of South Africa. Twenty responses were recorded, meaning a 65% response rate. This sampling was purposely selected among industry professionals and

contractors and this sampling comprises 10 quantity surveyors, 2 engineers, 2 contractors, 3 architects and 3 project managers. There were 14 questions in the survey and the respondents were requested to present their opinion on a Yes or No scale, whereas for other questions a 5-point Likert scale was adopted where 1=Never, 2=Sometimes, 3=Rarely, 4=Often and 5=Always.

RESULTS AND DISCUSSION

Table 2 represents the opinion of the respondents in terms of questions 1 to 10. This clearly indicates that 60% of the respondents agree with the statement that they did in fact have claims that were delayed as a result of lacking adequate supporting documents. In question 2, 75% of the respondents also agreed that they have had claims that were returned as a result of errors in the claim. In question 3, 50% confirmed they have had delays as a result of claims that were incorrectly calculated and 50% also said No on the same question. Regarding question 4, the respondents answered in the same manner as in question 3 where 50% of them agreed that they experienced delays as a result of a contractor failing to agree with the valuation of the work on site; 50% disagreed. In questions 5, 85% of the respondents were in agreement with the fact that they have experienced delays as a result of clients or client representatives wrongfully withholding their payment. In question 6, 60% of the respondents indicated that they do have some cash reserves to operate their business while their payments are delayed. In question 7, 65% of the respondents agreed that they rely on credit to finance their projects whenever they experience any delays in payment. In question 8, 75% of the respondents agreed that there should be legislation to regulate late or non-payment. For question 9, 100% of the respondents agreed that late payment affects their cash flow. In question 10, 60% of the respondents agreed they have suspended work in the past as a result of late or non-payment.

	Question	**Yes**	**No**
1	Was your claim ever delayed as a result of lacking adequate supporting documents?	60%	40%
2	Did you ever have a claim returned as a result of an error in the claim?	75%	25%
3	Delayed as a result of an incorrectly calculated claim?	50%	50%
4	Delayed as a result of contractor failing to agree with the valuation of the work on site?	50%	50%
5	Delayed as a result of client/client's representative wrongfully holding the claim?	85%	15%
6	Do you have cash reserves to help your business operate when payment delays are experienced?	60%	40%
7	Do you rely on credit to finance your projects?	65%	35%
8	Should there be legislation that regulates non or late payments?	75%	25%
9	Do late payments affect your cash flow?	100%	0%
10	Have you ever suspended work as a result of non/late payments?	60%	40%

Table 2: Summary of trends indicated by the survey

In question 11 in Table 3 below, 45% of the respondents said they have never charged interest on late payments even though this was addressed in the JBCC contract. Only 15% of the respondents indicated that they always charge interest on late payments.

To question 11, 30% of respondents said they always insist on clients providing a payment guarantee on their projects, whereas 20% said they never ask for a payment guarantee; 20% said they sometimes require a payment guarantee and 10% responded with Rarely.

	Question	**Never**	**Sometimes**	**Rarely**	**Often**	**Always**
11	How often do you charge interest on late payments?	45%	15%	25%	0%	15%
12	How often does your company insist on the provision of a payment guarantee?	20%	20%	10%	20%	30%

Table 3: Summary of the trends indicated by the survey

Regarding Table 4 below, 45% of the respondents said they would like to receive payment 14 days after invoicing, while 15% of the respondents said they would be comfortable even if they received payment 21 days after invoicing; 25% of the respondents indicated that 30 days after invoicing should be all right to receive payment and none of the respondents wanted to be paid after 60 days.

	Question	**14 days**	**21 days**	**30 days**	**60 days**
13	What period would you prefer to be paid?	45%	15%	25%	0%

Table 4: Summary of the trends indicated by the survey

CONCLUSION

It is evident from literature that this problem of late or non-payment is not new. Based on various literatures it can thus be concluded that:

The problem of late or non-payment is not improving when compared to previous surveys. More money in terms of fees outstanding for over 90 days is lost which could have helped in growing the economy from a South African market perspective. The rule to suspend work does not help the situation, however, slowing down the work does not relieve the contractor or consultants from the problem of cash flow and contractors and consultants must re-examine their positions from a common law perspective before entering into any contract with any clients. Legislation on non-payment must definitely be introduced in South Africa to address the problem of late or non-payment and more consultants and contractors must charge interest on late payments.

RECOMMENDATIONS

The following are recommended:

- That in the contract data, payment duration should be stipulated and agreed upon;
- Payment legislation must be adopted in South Africa;
- It should be made compulsory for government clients to produce a payment guarantee before any project can commence in South Africa;
- There should be a performance incentive for any government departments that pay on time, e.g. a bigger budget allocation on the following financial year's budget; and
- Compulsory interest on late or non-payments by government departments; the departmental head of that specific department must be accountable for late or non-payments.

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PERCEPTIONS IN CONSTRUCTION TO THE EDUCATIONAL NEEDS OF EMPLOYEES

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ABSTRACT

The need for increased time and geographical flexibility; fluctuations in the economy; increases in the cost of study; fast paced lifestyles; increased technological competence and job market demands for employees to gain new skill sets and professional and academic credentials means that employees are increasingly under pressure to make judgements in relation to choice and method of academic study and are concerned about how these choices will impact on future employability and translation into jobs or careers. Employers seek study options that provide value for money, address skill gaps, are flexible and have minimal disruptive impact on business operation and productivity. The research explored construction industry employer perceptions in relation to the educational needs of construction employees, in particular, types of qualifications employers want employees to have in future, traditional versus fast track degrees and attitudes towards the development of a general degree in construction. The study found professionally accredited qualifications and continuing professional education (CPD) to be high priority for employers, skills training and academic/professional qualifications to be viewed as of equal importance and the three year degree to be considered still relevant in the current job market.

Key words: Construction, Employer, Educational, Needs, Perceptions.

INTRODUCTION

The research was undertaken in the Professional Academy (PA) in the Faculty of Advanced Technology (FAT) at the University of Glamorgan. The Professional Academy is a European Social Fund (ESF) funded project, with a value to £2.3m. The PA provides a variety of work based learning (WBL) solutions to the Welsh workforce. The project aims to engage with companies in a variety of sectors including the energy and environmental management sectors in addition to automotive, aerospace and construction sectors to up-skill employees through flexible bite sized learning opportunities. Graduate employment is being adversely affected by the current economic climate (CBI 2009). It is

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with the depressed labour market and policy steers from (Leitch 2006), (Welsh Assembly Government 2002, 2005, 2008 and 2009) and the (RICS 2009a) Consultation Document on employability in mind that has led to the Professional Academy offering academic support and guidance to both employers and employees looking to engage in work based learning solutions. The PA wanted to engage with employers to explore training needs and develop new ways of developing and delivering courses that were attuned to market trends and needs, and be attractive and innovative enough to convince employers to release employees to engage with short term learning.

BACKGROUND

Policy Initiatives – National and Welsh Assembly Government

The need for universities to engage with industry has increased dramatically in recent years. (Lambert 2003) identified collaboration and partnership as key factors to achieving success in producing more industry aware/relevant graduates and higher level research and development (R & D) within industry. The (Leitch Report 2006) and three Welsh Assembly Government (Welsh Assembly Government 2005, 2008 and 2009) policy initiatives, the "Learning Country Vision into Action", 'Skills that Work for Wales' and 'For Our Future' suggest it is now timely and in line with government policy, both national and Welsh, to enrich the higher education curriculum with greater awareness of the value of work based skills and learning through work. One of the main recommendations of the (Leitch Report 2006) is to increase an individual's aspirations and awareness of the value of skills and to raise the profile of vocational education. This driver is echoed in the Welsh policy 'Skills that Work for Wales' (WAG 2008) document.

The 'Learning Country – Vision into Action' (WAG 2005) stresses the need for informal and work based learning to become a recognised and accredited part of the curriculum. This emphasis on work placement as part of the curriculum and the importance of graduate employability were reiterated in the 'For Our Future' (WAG 2009) policy. In response to the Government's 2003 Higher Education White Paper HEFCE gave development funding from 2005 to 2010 to eight higher education institutions to pilot forms of flexible provision. These institutions, the Flexible Learning Pathfinders, piloted a range of provision which included two-year accelerated Honours degrees, delivered via a variety of flexible learning methods. The final report recommends actions that could be taken in order to support the development of flexible learning in particular, provision of better information for prospective students about availability of flexibly delivered courses and alternative study options; basing fees on credits delivered rather than years of study; changes to institutional structures and systems to support flexible delivery and demonstrating that accelerated degrees deliver similar outcomes to conventional degrees.

Economic

The UK economic downturn continues with overall employment in construction about 59,000 fewer in 2012 Q1 than a year earlier (Green 2012). Recent research has shown the impacts of the recession on the employment prospects of all property and construction graduates and speculated that the ongoing cuts in public expenditure on construction and infrastructure projects will continue to make the job market for graduates difficult in the foreseeable future (Devaney and Roberts 2012). The gloomy economic outlook combined with the recent requirements from RICS relating to the development of graduates' employability skills and greater employer/industry engagement encouraged the Professional Academy to develop a project that would enhance graduate employability through propagating a positive culture of professionalism.

Academic

In studying the alignment of professional, academic and industrial needs for Quantity Surveyors in a post recession climate, (RICS 2011) highlighted how the professional and training needs of Quantity Surveyors are pulled by three different stakeholders (academia, professional body and industry) in three different directions. The academic focus is on producing graduates with a basic foundation in knowledge for further development, professional bodies are interested in graduates who can be progressed to full professional status through the achievement of the required core competencies (RICS, 2009b) whilst industry is looking for graduates who can immediately contribute to the daily functions of business activity and its growth. This tripartite three dimensional pull on development needs in the present education system produces graduates whom the industry sees as not fulfilling their requirements, leading to many problems, with greater levels of employer and graduate dissatisfaction and obstacles to early career development of the QS graduate.

RESEARCH METHODOLOGY

The research reported in this paper was conducted in late 2011/ early 2012 and forms part of a wider study, which was conducted with employers and employees in the construction industry in order to learn about their work based and e-learning needs and to inform future course design and educational delivery. In particular the research focussed on the types of qualifications and courses employers and employees are interested in studying in future. This included professional accreditation and continuing professional development (CPD), employer and employee attitudes towards traditional degree courses, the importance of gaining academic and professional qualifications versus relevant skills training, preferred method and mode of course delivery, and suggestions for the development of content and exploration of value and applicability of a general degree in construction.

The study relates directly to the aim of the (ESF) Professional Academy Project which aims to transform the way that the Faculty of Advanced Technology traditionally delivers modules by allowing employees to study directly from the workplace in a variety of ways, including innovative live streaming of lectures**,** online distance learning materials and also bespoke training where businesses can directly access the expertise of academic staff in order to address skill gaps.

Semi structured interviews were conducted with 43 employers (in 29 companies) and 24 employees from those companies in the construction industry who were being supported by the Professional Academy. The duration of the interviews ranged from 20 to 45 minutes. Interviewees included a range of: Housing Associations; large national/multi national construction contractors; small to medium sized enterprises (SMEs); local authorities; building consultancies and Construction Skills Wales. The organisations were categorised for analysis as follows: Consultant (n=10), Education Provider (n=3), Contractor (n=17), Housing Association (n=11), and Local Government (n=2).

The interview questionnaire was mainly qualitative in nature and consisted of open ended and multiple choice questions, with accompanying follow up probe questions (to more fully explore the views of employers). The interviews were conducted by telephone and the researcher took detailed notes in relation to each question. The notes were then transcribed and the data was coded in relation to each respondent answer for each question. The data was analysed using the qualitative method of content analysis in order to discover the regularities occurring in the interview discourse, identify and categorise

answers and establish connections between them (Holsti 1969; Riley 1990). In order to provide the quantitative data for the analysis, the answers to the multiple choice responses were frequency counted.

RESULTS

Entry to employment - required future qualifications

Employers indicated a broad variety of qualifications that they required employees to have on entry to employment. Almost half of those interviewed specified the need for employees to have a relevant degree, e.g., Quantity Surveying, Civil Engineering, Project Management, Mechanical Engineering on entry into their field of occupation. Only four employers indicated that degree level qualifications were less important for entry (unless applying for a specialist job) and that employee qualifications on entry ranged from NVQs, HNCs, HNDs to degree level. Employees were expected, and/ or encouraged to progress educationally after becoming employed.

Small to Medium Sized Enterprises (SMEs) and Housing Associations indicated if they required specialists in particular fields it was more cost effective for them to hire specialist consultants. A small number of employers (in large national/multi-national consultancy/ contractor organisations) indicated that study involving a regular time commitment as day release from work can act as a distraction (especially if employees are required to take 2-3 days off per week). They felt employees were less committed to their regular job (through the need to focus on study) and were disadvantaged in job placements and project allocation when compared with other full time staff, as they are less available and have reduced flexibility.

Professional Accreditation

Almost all of the employers who were interviewed indicated the importance of chartership status within a chosen field, e.g., RICS, CIOB, ICE and RIBA. RICS and CIOB appeared to be the most commonly occurring accredited professional qualifications indicated by the employers who were interviewed; however this may have been skewed in this direction because the employers were from the construction industry, where there is a heavy representation of RICS and CIOB. Employees were encouraged to pursue chartership, either through obtaining an accredited degree, Assessment of Professional Competence (APC), external top up courses, or in-house training. Chartership was viewed as the most important educational aspiration for employees for two reasons: firstly, it provided value to the employee as a recognised professional qualification which would benefit the employee long term. Secondly, it made the company/organisation more competitive in the market when bidding for work, as client confidence was based on perceptions of team competence and professionalism, which could be validated by demonstration of professional qualifications and membership of professional associations and bodies.

Continuing Education

Employers highlighted the value of short, modular courses in subjects such as, project management, health & safety, sustainability, environmental issues, waste management, and carbon management. In addition, they expressed an interest in ‘soft skills’ courses in staff management, and leadership skills. Short courses were attractive to employers as it boosted CPD whilst at the same time taking employees out of the work situation for shorter periods of time, enabling companies to remain competitive in the market in this difficult financial climate. Few employers indicated that they wanted employees to progress onto Masters level qualifications and did not feel that this type of qualification

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was relevant to them. One contractor indicated that a moratorium had been placed on Masters courses for employees unless there was a very good business case to indicate value and benefit for the company for that type of qualification. Overall employers felt that skills training and experience were equally as important as professional and academic qualifications. Academic and professional qualifications were felt to be important for potential employees to get to the interview stage of recruitment however, the ability to demonstrate skill and experience at interview and the ability to perform well in the role was felt to be more important post recruitment.

Employer opinions of a 3 year and 2 year degree course

Opinion was divided almost equally amongst employers in relation to a three year degree being an outdated concept. Twelve employers (28%) were unsure if a three year degree was an outdated concept and did not feel qualified to comment, sixteen (37%) felt that there was merit in preserving a three year degree and fifteen (35%) felt that there was merit in shortening, or fast tracking the three year degree. Twenty five out of forty three (58%) employers said that they would value a shortened degree as they felt it would provide a more attractive option to mature/older learners, potentially lower student drop-out rates and offer a solution to allow people to enter the job market more quickly which they felt was particularly important in the current economic climate with the potential negative impact of increases in university fees. However, despite advocating a shortened degree in the current financial climate, employers provided a caveat that the depth and breadth of the content would need to be preserved and quality assured in a more intensely delivered degree programme (to ensure that the qualification was not perceived as devalued).

Attitudes in relation to the development of a General Degree in Construction

Employers were supportive of the concept of introducing a general degree. Thirty out of forty three employers (70%) felt that it was a good idea, as opposed to ten who did not. Those who were supportive of the idea felt it provides a broader base in choice of career, a wider range of skills and does not pigeon hole people too early in their choice of career. A generic qualification in construction was felt to be good for smaller organisations who could not afford to engage a team of specialists. Employers who were unsure (7%) or who thought a general degree was a bad idea (23%) did so because they felt that specialist roles within companies require specialist degrees and that the area of construction is too broad to allow teaching modules to cover any significant depth that would prove useful to employers. Deciding upon the content of a proposed general degree proved difficult for employers as the range and variety is very broad. Employers had differing needs and priorities of what it would be important to include. They felt that it is important to reflect current trends within the construction market whilst at the same time providing a broad grounding across the subject area. Perhaps this and the mandatory competencies requirements account to some extent for 6 out of 500+ RICS awards being general (3 of which are in the Far East).

DISCUSSION

Academic/ Professional Qualifications and Training

It was significant the half of the employers still felt that a degree was necessary as an entry level qualification for employees. Although employment of graduates with specialist qualifications was favoured in contractor/consultancy organisations, local government and Housing Associations favoured generalists and stated they would prefer to sub contract specialists as overall this was more cost effective. A small number of employers in the

larger companies indicated that although they support employee education and continuing professional development, time commitments for study can have a negative impact upon employee flexibility and the allocation of employees to projects with clients.

All of the employers who were interviewed indicated that they would encourage employees to do some form of study both formal and informal post employment. CPD can be formal and informal, on-the-job experience, training courses and full accreditation and membership of professional bodies.

Chartered accreditation was indicated as very important by almost all employers interviewed as a means of measuring professional competence amongst peer groups and as a business imperative as an assessment criteria for pre qualification of work in the tender process in an increasingly competitive market. Employers indicated the value of short, modular courses for continuing professional development of employees and the development of employability, professional and soft skills were important for employees. With this in mind it is important that higher education continues a dialogue with industry to map the fit between the graduate labour market and employer/industry needs and future skills development of employees as highlighted in national and Welsh policy outlined above. It is important that there is an understanding of the need and motivation for training from employers through the development of short courses, and soft skills to delivery of compulsory components of CPD, so that Higher Education can develop this in a logical and coherent way.

Shortened degree courses

The University and College Union Briefing Paper (UCU 2010 p2) in response to the Government announcement to support an increase in the number of 'fast track', two-year degree programmes expressed concerns that *"fast track programmes will make it harder for students to combine study with periods of reflection, critical thinking and a 'deep approach' to learning"*. The final evaluation of the HEFCE funded Flexible Learning Pathfinder project reported the Pathfinders have had some success in introducing, sustaining and developing flexible provision, particularly accelerated degrees and work based learning with some potential, in the new fees and funding environment from 2012-13, for the expansion of flexible provision, although it notes the current high demand for traditional degrees. Detailed statistics on study outcomes and student employment destinations were not available at the time of the evaluation. However, there is some evidence in the HEFCE Pathfinder project that accelerated degree students' achievements are comparable t those of equivalent three year degree students.

This view appears to be reflected to some extent in the employer views captured in this study where 58% of employers said that they would value a shortened degree as they felt it would provide a more attractive option to mature/older learners, potentially lower student drop-out rates and offer a solution to allow people to enter the job market more quickly.

Employers who felt that a three year degree has merit and should be preserved within the modern education system welcomed the time afforded for introduction of concepts and for people to develop meaningful maturity of these concepts over a three year period in preparation for their future career in construction and for the opportunities it provides during holidays for valuable work experience. Also for the added value it provided to enable students (especially school leavers) to mature into world of employment. This

reflected the views expressed by the University and College Union (UCU 2010) that fast track programmes will make it harder for students to combine study with periods of reflection, critical thinking and a 'deep approach' to learning.

A general degree in construction

Employers were positive about the usefulness of developing a general degree in construction. However, the need for accreditation of employees i) to demonstrate professional competence and ii) to increase desirability to clients, in an ever competitive marketplace presents a paradox. For example, the requirement to achieve the RICS competencies is somewhat at odds with development of a general degree and places employer attitudes towards the development of course content somewhat at odds with the requirements of professional bodies, e.g., RICS. In support of this the (RICS 2011) highlighted the conflicting concerns that have long fuelled the "education versus training" debate and conflict between educators and employers through which RICS steers a sometimes difficult path.

Nevertheless the decision to specialise or pursue a more generic qualification has far reaching implications for employees in relation to employability post graduation. The sector is dominated by small to medium sized companies with a small number of employees. In such organisations the job prospects of a generalist are good however the job prospects of a specialist would be more favourable than those of a generalist in a large company with a large number of employees. Job placement as part of university courses tends to be with medium and large sized companies, this begs the questions: 'would students pursuing a general degree be disadvantaged?' and 'would there be a mismatch in qualification and employment placement requirements?'

CONCLUSIONS

Almost half of those interviewed specified the need for employees to have a relevant degree on entry into their chosen field of occupation. Employees were expected, and/ or encouraged to progress educationally after becoming employed. Almost all of the employers who were interviewed indicated the importance of chartered status for employees. Overall employers felt that skills training and experience were equally as important as professional and academic qualifications.

It was encouraging to discover that the three year traditional degree is still viewed as an important and relevant learning mechanism by employers in the construction industry. It will be interesting to discover the full impact of the findings of the HEFCE funded Flexible Learning Pathfinder projects, the economic climate, and new fee increases on student numbers, the degree and Higher Education.

Despite high levels of support from employers for the development of a general degree in construction (as a potential means for attracting new students post A level) problems with accreditation to professional bodies, e.g., RICS, due to the need for completion of Mandatory and Core competencies present barriers to flexible development of such courses in the near future.

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STRATEGIES TO ADDRESS SKILLS SHORTAGES IN THE NIGERIAN HOUSE CONSTRUCTION SECTOR

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ABSTRACT

The current skills shortages in Nigerian House Construction Sector has constrained the productive capacity of the sector and aggravated the nation's housing problem. Past policies have largely failed to address the realities of the skills crisis occasioned by a weak and neglected apprenticeship and poorly developed vocational education and training systems. Insufficient research efforts directed towards skills concerns, non participation of employers in training, lack of recruitment strategies and a faulty and rigid National Qualification Framework are major factors negatively impacting the construction skills development. This paper reports a pilot study of a doctoral research work with a focus on technical colleges in charge of the formal training. Strategies for addressing the skills crisis are offered. These include education policy reforms to give priority to vocational education; adequate funding of the vocational education, a review of the National Qualification Framework to integrate the colleges with the university system; reforms of the policy framework establishing the regulatory mechanism; public reorientation on image of the artisans and provision of incentives schemes to attract potential artisans.

Keywords: construction, housing, skills shortages, strategies, training.

INTRODUCTION

Housing has been accepted as one of the three basic needs of mankind. It is most important for the physical survival, after the provision of food (Agbola and Olaoye 2008). Adequate housing contributes immensely to the physical and moral well being of a nation and advances social stability, work efficiency and the development of individuals. It is also one of the most suitable indicators of a person's standard of living and other standing in the society (Osowe, 2011). Housing problems remain a global phenomenon in the developed and developing nations of the world.

Nigeria has a population of over 140 million and an estimated growth rate of 3.2% (Nigerian National Population Census, 2006). Consequently, Nigeria has an enormous housing deficit, estimated at 12-14 million housing units (Akeju, 2007; Aikhorin,

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2008). At an average cost of N2.5 million per housing unit, Nigeria would require N35 trillion (about USD24 billion) to fund a housing deficit of 14 million housing units.

Many factors are responsible for this acute housing problem the world over; these are entrenched in the components of the housing delivery system (Jinadu, 2004). They are Land, Finance, Human Resources, Building Materials, Government Policies, Construction Technology and Regulatory Mechanisms.

This study investigates the human resources aspect on the supply side of the problem, with specific focus on artisan skills development for housing delivery in Nigeria. This has been identified by several authors as a major challenge to adequate housing provision (Awe, Stephenson and Griffith, 2010; Adeloye, 2008; Akindoyemi, 2005; Agbola, 2005; Eneh, 2010; Olaoye, 2007; Fatimilehin, 2010; Jinadu,2004; Nworah, 2008 &UN-Habitat, 2008; Agbola and Olaoye, 2008). The following sections describe the problem, the context, the technical college system, the importance of artisan skills development, the methodology, findings and conclusions of the study.

THE PROBLEM STATEMENT

Sanni and Alabi (2008) observe that persistent neglect of the artisan training system by government has led to a drastic fall in enrolment of new intakes into building trades in the technical colleges in Nigeria. Consequently, it created a gap between demand and supply of artisans. This gap became wider with increased investment in shelter provision especially by individuals and families due to fast rising housing rents caused by pressure for accommodation especially in the urban centres (Agbola 2005). Dainty, Root and Ison (2004) contend that employers' indifference to investment in artisan training negatively impacts the supply of the required workforce for construction work. In Nigeria, employers' participation in artisan training is almost nonexistent, which further widens the gap between demand and supply of skilled artisans. The fallout of this is manifest in the difficulties faced by developers in sourcing suitably qualified and experienced artisans for house construction projects. Adeloye (2008) laments that

…."*yes there is lack of trained artisans in the country, and that only construction firms can sort it out, ...we have to sort out a unified building construction training scheme that trains our artisans and probably rewards those skills".*

Nworah (2008) reports that there is an upsurge of migrant artisans and craftsmen from neighbouring African nations like Togo, Benin Republic and Ghana in the recent time to Nigeria attracted by building contracting firms to fill the gap created by inadequate artisan supply locally. This is totally unacceptable in a country that has a high unemployment rate of 20% (NPC, 2006)

Given the exponential growth rate of Nigeria's population which was put at 3.2% by the Nigeria National Population Commission (NPC 2006); by this factor, new households are being formed pushing upward the demand for more housing units, hence the demand for more construction artisans such as masons and carpenters. Jinadu (2004) submits that the rise in disposable income since the return of democracy in 1999 has positively impacted on housing affordability of many public servants. The Federal Government of Nigeria (FGN) Vision 20:2020, a developmental plan to transform Nigeria to one of the top twenty economies of the world by the year 2020 is another point of concern that requires a large stock of artisans for its realisation. An estimated sum of one hundred and eighty billion Naira (USD1.2

billion) is to be spent on housing to construct 840,000 housing units. The study seeks to address the challenge of house construction artisan shortages with the view of developing appropriate strategies for an adequate supply of artisans.

SHORTAGE OF SKILLED ARTISANS FOR THE HOUSING DELIVERY PROCESS

There is an acute shortage of skilled artisans who are needed for the transformation of design to physical reality. Artisans such as masons and carpenters are in shortage both in quantity and quality (Agbola and Olaoye, 2008). A stakeholder in the industry remarked:

> '*……there is a great lack of skilled workers in the housing construction market; we need them in various shades…*' (Wharton, 2008).

The scarcity is not only in number but also in quality. The few available ones have very poorly developed skills which are usually evident in their poor workmanship, leading often to non-conforming work and reworks. The overall implications mean a cost and time overrun on contracts, increased maintenance costs and the reduced life of the building (Han, Lee, Fard and Pena-Mora, 2007). Nworah (2008) states that there is an upsurge of outsourcing of skilled artisans from neighbouring countries like Togo and Ghana to save time and cost. Nworah (2008) observes that this is a worrisome development and suggests that there is a need for government to re-focus on technical and vocational skills development to service the construction industry.

According to Fatimilehin (2010), artisans are vital to efficient housing delivery and the sector creates employment in most economies. However, in Nigeria, the persistent shortage of local skilled artisans has made developers and contractors resort to importing such skilled hands. Fatimilehin (2010) maintains that Nigeria loses a lot of money in capital flight to foreign skilled artisans and yet there is a serious unemployment crisis within the country.

THE NATURE OF ARTISAN TRAINING IN NIGERIA

There are two main systems of artisan training in Nigeria, namely the traditional apprenticeship system (informal training) and vocational technical college system (formal training). The focus of this paper is, however, on the latter system

TRADITIONAL APPRENTICESHIP SYSTEM

Traditional apprenticeship in Nigeria exists as a form of an agreement between a master-artisan and the apprentice. The apprentice is trained for a specified craft or trade through practical experience under the supervision of the master-artisan. It is a form of on-the-job training which allows the apprentice to learn by observation and practice (Iyamu and Uwameiye, 2002). This is a common method of training youths in trades and crafts to become empowered economically through jobs like carpentry, painting, bricklaying and decorating. The youth have developed apathy to skill acquisition as they prefer alternative approaches that will fetch quick money instead of learning a vocation (Eneh, 2010). The present stock of artisans is ageing and many of them do not have new apprentices to mentor and knowledge transfer is made difficult. This poses the great danger of extinction of the apprenticeship system (Eneh, 2010).

VOCATIONAL TECHNICAL TRAINING COLLEGES IN NIGERIA

Vocational Education is any form of education whose primary purpose is to prepare persons for employment in recognized occupations (Ajokorise, 2010). It has also been explained as the sum total of all educational experiences systematically organized and presented by an institution to enable the learner to acquire basic productive and practical skills (Oharisi, 2007).

Therefore, Vocational Education, also called *Career and Technical Education*, prepares students for jobs and careers that are based on mostly manual or practical activities. The term does not apply to the development of professions acquired via tertiary institutions. Vocational education is low on theoretical or academic activity and is generally related to learning a specific trade or occupation. It is sometimes referred to as *technical education,* as the learner directly develops skills in a particular trade that promotes considerable self-employment.

Vocational education teaches procedural knowledge for acquiring a skill or trade in contrast to general education that concentrates on theory, abstract knowledge and research. Vocational education provides instruction that is usually given to those who need employment in commerce and industry or in any type of enterprise that involves the use of tools and other machinery (Ajokporise, 2010).

PROBLEM WITH TECHNICAL AND VOCATIONAL EDUCATION IN NIGERIA

Vocational education and training offers the best opportunity to produce an employable work force in any country. Oni (2006) argues that in the distressed economies of the third world, there are no clear and workable policies in place for vocational education and technical training. Educational policy implementation in Nigeria, for example, is haphazard. The 6-3-3-4 education policy, (which means 6 years in the primary, 3 years in junior secondary, 3 years in senior secondary and 4 years for tertiary education), that was designed to develop middle cadre technicians has collapsed. Oni (2006) opines that every developing nation needs the efficient service of technicians, engineers and technologists who have received formal training from vocational-technical institutions.

The vocational technical colleges have been generally ineffective and largely neglected by government (Aturu 2011). Education policies are unfavourable to the vocational segment making no proper provision for its integration into the National Qualification Framework (NQF) and as a result, career progression is difficult for vocational graduates (Aturu 2011). African Union (AU) (2007) asserts that in many African nations the quality of Technical and Vocational Education and Training (TVET) institutions is low, instructors' trainings are inadequate and training equipment are outdated. This unfavourable learning environment negatively impacts the quality of the products who are the artisans. Aturu, (2011) submits that there is a poor public perception of technical and vocational education and training; it has been considered as a career path for less academically endowed. African Union (2007) argues that TVET is left for the rural poor and the economically disadvantaged to learn a trade. This perception has been fuelled by the academic requirement for admission and limited prospects for further education and career development. AU (2007) further states that the worst impression is sometimes created by government

that the primary objective of vocational education is to keep the dropouts off the streets rather than project this type of training as an effective strategy to train skilled workers for employment and for sustainable livelihoods. Aturu (2011) contends that while the United Nations Education Scientific and Cultural Organisation (UNESCO) recommends that at least twenty six percent (26%) of the national budget should be allocated to education, in Nigeria, it has always been less than ten percent (10%). For instance in the 2010 budget, N249.08 billion was allocated to education out of a budget of N4.07 trillion which translate to six percent (6%) of the total budget (National Budget Office 2011). Vocational education is worst hit by the inadequacy as it is maginalised in the sharing of education allocation from the national budget. For instance, available data indicate that out of the allocation for education in 2003, 2004 and 2005, vocational education only got 20.9 percent, 7.1 percent and 13 percent respectively (NBTE 2008). Vocational training in Nigeria is largely uncoordinated and lacks proper government regulation and intervention.

METHODOLOGY

A quantitative research survey was conducted with a focus on the technical colleges which engage in formal training of the house construction artisans using a structured questionnaire and physical survey/observation. This was coupled with an extensive review of literature. Fourty eight (48) questionnaires were administered on the management and other staff members of twelve vocational technical colleges to elicit information on issues relating to training such as teaching and learning strategy; staffing; physical infrastructures; training facilities and library resources; regulatory mechanisms; Government policies and level of funding. Fourty two (42) were returned and analysed representing 87.5% return rate. Additionally, physical survey/observation was carried out in the colleges to get an insight into physical infrastructures and training facilities available for training and how artisan training takes place in practice.

FINDINGS AND DISCUSSION

The study exposes major concerns among the stakeholders of the formal training system of house building artisans. The respondents were quite aware of the situations facing the training system and the impact of the skills shortages on the House Construction Sector. It was found that the regulatory mechanism for the technical training colleges, the National Board for Technical Education (NBTE) is weak and ineffective; giving inadequate attention to quality and standard regulations. The (NBTE) has almost neglected the technical training colleges to run on their own, this is partly due to too large scope of operation to cope with as the same NBTE is responsible for 57 polytechnics, 43 monotechnics apart from the technical colleges. Its emphasis seems to be on the polytechnics at the expense of the technical colleges, thus leading almost to a state of system collapse of the technical colleges. The stakeholders within the Polytechnics system have always requested for a separate regulatory body, the National Polytechnic Commission, (NPC), so that NBTE will be able to give dedicated attention for technical colleges while the NPC takes care of the polytechnics. However, till date this is still being resisted by those opposed to vocational education among the policy makers.

The available physical infrastructures such as offices, workshops, classes and hostels are grossly inadequate, 40 respondents representing 95% indicated that the conditions of the buildings in the colleges are lacking adequate maintenance. 32 respondents representing 76% agreed that the colleges surveyed do not have appropriate buildings for the library while 34 respondents representing 81% opined that relevant textbooks, IT infrastructure and other resources required for proper training were lacking in the colleges. Workshop equipment for practicals were found obsolete by the researcher and 29 respondents representing 69% agree that the training equipment were outdated. While the level of practicals conducted for trainees are grossly low, the training contents are more of theoretical instructions; 30 representing 71% of the respondents said the review and update of teaching methods are not regularly carried out as expected. 38 representing 90% of the respondents indicated that the available teachers are grossly inadequate due to government reluctance to employ more staff, coupled with poor remunerations and other conditions of services. 61% of the respondents believed the qualifications of the teaching staff members were inadequate, many having the minimum teaching qualification requirements, the National Certificate of Education -technical (NCE). This is not unconnected with a general absence of staff development policy in place in the college system. All the respondents agree that the level of funding received from the government for running the colleges is grossly inadequate.

Government policy on technical and vocational education as compared with general education is imbalance; most respondents (95%) indicated that the Government policy framework on the rating of technical college certificates is poor; the policy on career progression with technical certificates is harsh, making no provision for integration with the university, thus making vocational education system a dead end. This has negatively impacted the societal image of construction workers and other vocational graduates. The operation of a rigid National Qualification Framework (NQF) is a potential factor that is responsible the poor patronage of the technical colleges. Policy makers, most of whom are drawn from the university system are biased against vocational technical education, holding the belief that vocational education is inferior and meant for the educationally disadvantaged fellows or dropouts in the society. Therefore, in their policy making process, they deliberately oppose attempts to make provisions for career progression for vocational graduates through creation of proper integration path with the university system.

STRATEGIES

Efforts to create a sustainable future supply of construction skills for the House Building Sector must begin with a genuine and unbiased policy reforms in the education sector. Authorities should give appropriate recognition to vocational education backed with a robust media campaign to promote its careers. This must be followed up with a strong political will to implement the reforms; as unimplemented policy is as bad as poor policy provisions. A flexible NQF is required where vocational qualifications are integrated with the University to ease the career progression of its aspiring graduates. A solution to the challenge of standard and regulation would require a dedicated regulatory mechanism for the technical colleges to monitor and maintain a high quality standard in the training of artisans for the Construction industry. This will require regular visits for programme accreditation and institutional auditing of the colleges. An entirely new regime of funding is needed to make available adequate physical infrastructures, appropriate training facilities,

library resources, IT infrastructures and training incentives or scholarships to attract new entrants to the colleges. Provisions for staff development policy are necessary for training and retraining of technical college teachers; Improved salaries and robust welfare packages for teachers are imperatives to attract talented human resources to the system. Encouraging employers to invest in training will boost the productive capacity of the colleges and in turns reduce the skills shortages.

CONCLUSIONS

This study is set out to collate and synthesise the most appropriate ways to tackle the skills shortfalls currently affecting the house construction sector with a focus on the technical colleges saddled with the responsibility of formal training of artisans. The research has revealed the need for a strategic skills policies formulation and a combined approach for skills planning in order to mitigate skills shortages and provide for sustainable future skills supply.

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TRANSITION FROM UNIVERSITY TO THE WORK PLACE: A CASE OF GRADUATE EMPLOYABILITY SKILLS IN THE CONSTRUCTION INDUSTRY

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ABSTRACT

This study was seeking to showcase the construction industrial requirements of the construction graduates, employability levels and their contribution to the industry. Graduates from two universities (Witwatersrand and Pretoria were chosen, in the period 2007 to 2010, were contacted through emails and telephone. The graduates in all cases felt they lacked confidence in their ability to perform effectively without supervision. There was discrimination between the graduates from both universities as the managers were biased towards their alumni. The site managers because of the nature of the construction industry could not entirely trust the graduates to run a site until experienced. However the industrial leadership was satisfied with the qualifications of the graduate's as they have been involved in the design and lecturing of these courses as some of them are external examiners. Some of the graduates within this province are no longer linked to these universities at all. Some of the graduates have changed professions into other fields or left the country. It is important that students before graduation should fully understood the nature of the construction industry by periodically visiting construction sites, and carryout some problem solving researches.

Keywords: employability, industrial expectations practical skills, skills mismatch and sustenance.

INTRODUCTION

A student who has graduated is expected to be ready for the workplace; to have the skills and ability to apply knowledge effectively using a minimum outlay of time, cost, and energy. However, according to Pauw, Oosthuizen & Westthuizen (2007) graduates making the transition from university to the workplace lack the practical skills required in the construction industry, and there is a mismatch between the skills provided by graduates and those required by the industry as "priority skills", specifically, practical skills.

Background

The government has been promoting skills development in South Africa for many years through bursaries, youth programs, scholarships and awareness. One area that has not been properly addressed is the development of practical skills to a level of sustaining the construction industry. In this study it was found that there were three possible reasons for skills shortage in South Africa. The first is the legacy of apartheid on the educational system, the second is the impact of post-apartheid emigration in the construction industry and the third is the mismatch between the skill requirements of employers and the skill output of the universities. According to the National Planning Commission of South Africa (2011), there was a significant increase in student enrolments in the period 2001–2010 and student enrolment has been increasing by an average of 4.6 present per year, but under-preparedness of many learners entering tertiary institutes demand for support programmes that many tertiary institutions find increasingly difficult to meet. According to Bailey (2003) since 1994, there has been an increasing net loss of skills from South Africa. It was estimated that 2 891 professionals in the built environment and engineering field left the country in comparison to the 1 063 that were immigrating to South Africa between the period of 1994 and 2000.This has prompted an increase of professionals emigrating to 6.2% each year since then. The main factors prompting emigration for young professionals are the opportunity to gain international work experience and the cost of living in South Africa.

History of education in South Africa

Education is the key process that is used to link the individuals, cultures and the economy in order for the environment to run smooth and effectively. Society is constantly changing and for the individual to survive, education is needed (McKerron, 1934) When the Dutch settled in South Africa in 1652 they never had colonization as their main aim, it was the Dutch East India trade, but in Holland the government funded education and the Reformed Church ensured that sound religious teachings where put in schools. The Cape settlers were so proud of their mother countries teachings that they tried to carry on those principles in South Africa. According to McKerron (1934) in the beginning of the nineteenth century, a desire of higher education started to be noticeable because the number of posts in different fields such as construction and there was now a need for professional men. He summarised the development of higher education as follows;

		Year
South African College (Cape Town)	115 students	1829
Financial problems reduced to	20 students	1843
Annual grants by Government made available. pounds/student	200	1843
Finance from shareholders also came in		1878
University of Good Hope established similar to the University of London (1828)		1873
University act 1916 established 3 Universities a) University of Cape Town b) University of Stellenbosch c) university of South Africa (UNISA)		1918
TECHNICAL COURSES offered by South African School of Mines (Kimberly to Johannesburg later)		1996
Transvaal Technical Institute (Johannesburg)		1904

Changed to Transvaal University College	1908
Two Campuses Pretoria and Johannesburg	1910
University of Witwatersrand	1921
University of Pretoria	1930

South African labour market

The Employment equity act was introduced in 1998 to empower affirmative action in South Africa. This act was designed to restructure the economy and create fair, equal and non-discriminatory opportunities for all. The department of labour has a right to send out inspectors to investigate if employees are complying with this act. (Burger and Jafta, 2010). However the main criticism of the Employment Equity ac t is that the government does not have enough qualified inspectors to ensure accurate data is recorded. Without proper inspections companies can ignore this act. (Bezuidenhoud et al, 2008).

Women in construction

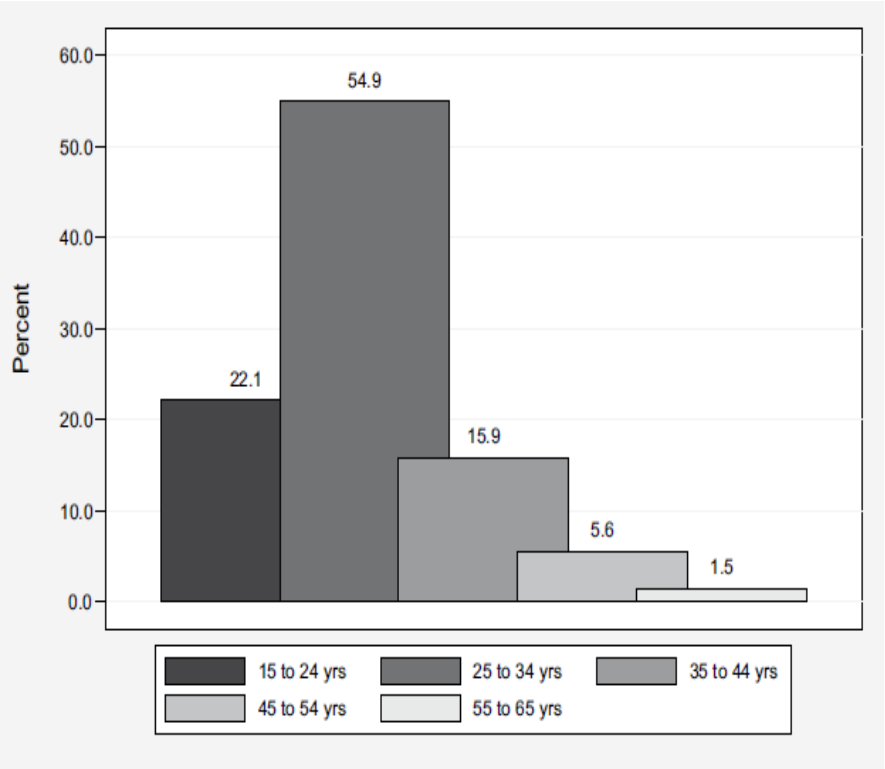
In a research conducted by Lin (2000) it was found that women make 50% of the population in South Africa and more than half of the women do not finish high school to get a Matric qualification which means these women do not have degree qualifications to be properly skilled to achieve top management, but however there are 5% of women who finish high school and acquire further education. Construction courses offered by universities are designed for both males and females and the workload is manageable by both male and female students .According to Lin (2000) for an individual to achieve a managerial position, a university degree is not the only requirement but still need good site experience that will enable the individual to understand the practical part of the industry rather than having a theoretical background. To get practical training and knowledge required from site is a challenge for a female graduate because construction is seen as a male industry and members of the construction industry prefer not to have women on site. Women are excluded from formal and informal training. Lin (2000).Further research by (Eksteen & Oosthuizen, 1996) found that there are 0.5% to 1% of female construction management graduates every year but the number of women entering the industry remains low because even though the individual has a degree, they do not get the practical experience required.

Skills shortage and unemployment

The construction industry forms an important part of the South African economy. It has undergone important changes and has been faced with new challenges in growth which can be largely attributed to changes in the country's political state of affairs. South Africa's economy has experienced an increase in productivity since its exposure as a democracy, leading to increase in pressure to compete in the world market. Resultant or, ripple effects were that industries had to be adjusted and upgraded to levels capable of achieving the desired production outputs, the large workforce required to produce at higher output rates had grown to include previously disadvantaged groups (though at first the change was concentrated in the semi to non-skilled work, in time it grew to include skilled / educated persons who now had opportunities to access fields in higher education), and an increase in the demand for skilled labour (I.e. specialised skills), to name a few. (Pauw, Oosthuizen, Westhuizen, 2006). All these effects have contributed to the economy developing a skills-biased labour market demand.

Graduate unemployment

In 2005, Statistics South Africa estimated that a total of 77 per cent of unemployed graduates were in fact youth, defined as individuals who fell within the age bracket 15 to 34. This suggests that majority of unemployed graduates are recent graduates (Kalie Pauw, Morne Oosthuizen, Carlene Westhuizen, 2006). The age composition of unemployed graduates is illustrated by the graph below:



(Statistics South Africa, 2005)

GRAPH 2.7.1.1: AGE COMPOSITION OF UNEMPLOYED GRADUATES, 2005

"The phenomenon of unemployed graduates, who are without abilities to self-employ and self-determine, after spending three to four years of post-secondary education is an indication to all of us of the challenge in our education at a tertiary level…the curriculum developers are not paying enough attention to issues of relevance and ensuring that we all pay attention to the skills and competencies learners require when they come out of higher education… we need a skills revolution in the curriculum of tertiary education."- (Mlambo-Ngcuka, 2006)

In 2005, Kraak suggested that poor throughput statistics at universities and technikons in South Africa "are yet another indication of the weaknesses of school education which should provide a more adequate preparation of entry and success in further higher learning", while, "the perceived poor quality of South African schooling (particularly in the former Bantu-education school system) serves as a major disincentive on the demand-side for employing first time entrants to the labour market.

Organisations in the South African Construction Industry

A List of some of the known organisations studied in this research.

- Construction Education and Training (CETA) after the Skills Development Act, no 97 of 1998
- Education and Training Quality Assurance (ETQA) by the South African Qualifications Authority (SAQA)
- Master Builders South Africa (MBSA)
- Master Builders and Allied Trades' Association. (the MBA)
- Association of Quantity Surveyors (ASAQS)
- Construction Industry Development Board (cidb)
- South African Council of Quantity Surveying Professions (SACQSP)
- Council for the Project and Construction Management Professions (SACPCMP)
- National Contractor Development Programme (NCDP)
- Chartered Institute of Building (CIOB)

POSSIBLE REASONS FOR PEOPLE LEAVING THE CONSTRUCTION INDUSTRY

The industry

The construction industry is one of the biggest industries mainly because the construction industry is not just a single industry, but it comprises of many sub-industries (Ive&Gruneberg, 2000).

Different groups

The construction industry is one of the most criticised industries in terms of its employment practices. The construction industry relies heavily on informal employment. Construction projects are done by a combination of firms and individuals that most likely have never worked together before or possible will never work together with again. Different groups of people are bought together and are expected to form a working relationship quickly and deliver successful projects. This creates tension among employees and tension arises from time and cost constraints (Dainty, Green, Bagilhoe, 2007). Research done by Haupt (2008) found that the facilities on sites need improvement and that the overall mind set of consultants need to improve. The construction industries health and welfare policies on site are not the same as the ones in the manufacturing industry. Workers in the manufacturing have better working conditions than construction employees. The research also found that the overall image of the construction industry was negative. These factors stated can demoralise construction employees. Haupt (2008)

Health HIV/Aids

HIV/Aids are a major contributor for workers leaving the construction industry. South Africa has one of the highest aids rates in the world and the construction industry is also affected. The elder construction artisans are the ones who are mostly affected and a possible reason for this is awareness. Some employees do not realise that they have the virus and hence do not get the treatment needed. (Haupt, Smallwood, 2003).

Other opportunities

Students who studied B.Sc. Construction management, B.Sc. Quantity surveying and B.Sc. Property studies can branch off into different careers paths such as project management, consultation, Human resources, lecturing, and property development. (Witwatersrand, 2011).

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CAREER PATHS

Quantity surveyor

According to The South African Council for the Quantity Surveying Profession (SACQSP, 2011) after obtaining a Quantity Surveying degree or other relevant qualification candidate quantity surveyors are required to do at least 33 months of in service training work under the supervision of a qualified quantity surveyor as the qualified quantity surveyor plays a crucial role in the training process and depending on their qualification, pass the council exams in order to prove their professional competence before they are allowed to register with The South African Council for the Quantity Surveying Profession. Qualification requirements (Quantity surveyor and Construction manager)

Construction Managers

According to The South African Council for the Project and Construction Management professions (SACPCM,2011) states that a minimum requirement to be registered as a professional construction manager is an accredited honours degree in the built environment field of study with a minimum of four (4) years' relevant post-graduation practical experience. According to (careerjet, 2011) the general requirement for posts in construction management is 7- 10 years' experience in the construction industry, this rules out the chances of graduates landing positions because they compete with experienced professionals.

RESEARCH METHODOLOGY

Qualitative research is any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification. Strauss and Corbin, (1990, 17) In simple terms qualitative research is data collection from observations, in depth interviews and questionnaires. Observational techniques are methods by which a researcher gathers first-hand data from programs, processes or behaviours being studied. Interviews involve direct interaction between the researcher and a respondent or group.

Population group

The population was limited to graduates entering the construction industry only and those who are job hunting or already working in the Gauteng province from the period 2008 to 2010. The issues that affected the selection of the population group are; experience in the construction workplace, abilities (looking at those possessed by graduates and those expected by employers in the construction industry) when making the transition into the workplace, as well as workplace performance. The groups of students and employers interviewed were diverse in order to represent the population make-up of the country itself. The questionnaires were not biased on culture, religion, or gender association. After randomly contacting (25 graduates responded) from the University of Witwatersrand and the others from University of Pretoria and issued questionnaires to the select group of graduates to see which graduates settled better in the construction industry. This in turn highlighted which curriculum is better suited to meet requirements of the industry. The study also identified eight construction companies (three large prominent companies, and three medium to small sized companies) to find out what they also expect from graduates by issuing questionnaires and conducting interviews.

A random selection technique was selected to choose eight construction companies in Gauteng. Three large prominent companies (can handle projects greater than R50 million); three medium companies carrying (can handle projects greater than R10million but less than R50 million) and two small companies (can handle projects less than R10 million). Questionnaires were issued to the managers of the various construction companies. A random selection technique was also used to choose the sixteen students, from the University of Witwatersrand and University of Pretoria which questionnaires were issued. This was done by telephone, mail and personal interviews.

Data Analysis

Results from interviews and questionnaires with, graduates and employers, were captured and used as research data for analysis. Data was acquired though face to face interviews and administration of questionnaires, phone interviews, and emailing questionnaires to respondents. All graduate respondents were qualified graduates within the construction industry (who were practicing in the industry). Pie charts were used to present the outcomes as they best illustrate percentages of a whole (best for respondent questionnaires). Bar charts were used where also used as a tallying of results was required, where a pie chart would not be suitable.

CONCLUSIONS

The findings showed that graduates generally felt that they were not exposed enough to information about their profession during their studies. Graduate respondents felt that they were not prepared for the industry; graduates felt that they had been less exposed to the industry's practical activities than they should have been, citing that, although they'd done the work in theory, the real life experience of the work was very different. This in turn had a negative influence on their confidence and progress in settling in on site. The results indicated that a great majority of the employers agreed that graduates have enough skills for the workplace except that they feel they may require more practical experience to better familiarize the student with the construction industry's work environment, which is heavily reliant on practical application and experience. This ability to apply skills can be achieved through tertiary institutes requiring a certain amount of time working in the field (vacation work), from all graduates in the construction industry, as due performance. This could also be achieved through construction industry organisations and associations investing in their newly qualified professionals by setting up learnership and apprentice programs. We can therefore conclude that although most employers are satisfied with graduates' overall performance, they highly value practical experience or prior exposure to the workplace and that the presence of practical experience in the graduates past can impact the graduates' ability to make their transition from their respective tertiary institutions to the construction industry.

RECOMMENDATIONS

Employers felt that the graduates had enough skills for the workplace and hence the problem lies with the graduates having confidence in their ability and being able to apply what they learnt. In order to instil confidence in the graduates universities must expose students to site conditions to familiarize them with their later working environment by requiring all construction graduates to achieve due performance as a necessity before they are deemed qualified. Graduates could also be put through training and internship programs by either the organizations within the construction

industry or by companies looking to employ the graduates before they start working. Construction organizations must be more involved than just giving memberships to the student. If they do not already, then they should consider providing mentorship programmes to their members. They could also sponsor some research in common problems that are encountered on construction sites as research topic or areas by final year students.

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AN ASSESSMENT OF THE LAGGED EFFECT OF INFLATION ON BUILDING MATERIAL PRICES: THE CASE OF NIGERIA

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ABSTRACT

The construction industry as one of the single largest industries in Nigeria makes significant contribution to employment, capital formation and Gross Domestic Product etc. However, the optimal performance of the sector is hampered by the volatility of building material prices. The study investigated the lagged effect of inflation on building material prices. Data were extracted from Central Bank of Nigeria (CBN) statistical bulletin and Guardian newspaper monthly publication of building material prices. The Distributed Lags Model (DLM) was used to analyse the effect of inflation on building material prices. The result shows that inflation or price level movement has a significant impact on building material prices between three to six months after their occurrence. The paper recommends that effort should be made by government to stem the tide of inflation through improve agricultural production, mining and local production of building material.

Keywords: Building Material Prices, Distributed Lag Model, Inflation, Lagged Effect, Nigeria.

INTRODUCTION

Inflation is born out of lack of effective monetary control. The high rate inflation in the Nigerian economy is a result of the creation of money by government that has no regard for the absorption capacity of the economy (Olashore, 1991). The phenomenal increases in the price of petroleum products in the mid-1970s and the foreign exchange crisis in 1980s further steams up the price rise (Uwah, 1995). Inflation undermines the rules of business, creates havoc and financial ruin of even the prudent. Inflation discourages savings, investment and productive activities given that the future value of money is not certain. The Uncertainty about future price levels could force investors to delay investment decisions, since investment is a sunk cost and largely irreversible. Without

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this uncertainty, consumers and producers could better plan for the future (Pindyck, 1991). No doubt one of the greatest problems facing Nigerian construction economy is persistently complex inflation (Fakiyesi, 1996). Inflation may have negative effect on project cost and time performance and may result in dispute and even outright project abandonment (Jagboro & Owoeye, 2004). Indeed inflation has had a crippling effect on the Nigerian Construction Industry (NCI) with a significant reduction in construction facility investment (Anunobi, 1997, Fawehinmi, 1998).

BUILDING MATERIAL PRICES

Building material alone constitutes about 60 percent of the total cost of building construction (Olubodun, 1986). The rise in the demand for building materials began at the end of the Nigerian civil war (1967-70) when Nigeria embarked on a massive rehabilitation of its infrastructure (Wahab, 1985). High demand, inflation and the downward trend in the value of the naira have led to the rising cost of building materials at a far higher rate than the modest increases in other inputs (Ojimelekwe, 1999). The difficulties in maintenance, high foreign components as well as high installation and running costs, frustrate production and hike in prices of building materials (Ofoegbu, 1998). The inadequate local supply and the restriction placed on the importation of building materials to meet local demand have created a persistent rise in building material (Jagboro & Atigogo, 2000). The unfortunate trend in the building material supply situation is that demand has increased over the years while local production has stagnated or declined (Jinadu, 2004). Additionally the unwholesome activities of middle men who engage in hoarding and black market sale of building material exacerbates scarcity and reinforce the inflationary pressure (Jagboro & Owoeye, 2004). Building material prices have increased by more than twice the Nigerian consumer price index in the two decades (UNCHS, 1996). The availability, adequacy and prices of building materials form a crucial constraint to housing development programmes in developing economies (UNCHS, 1987 and Jinadu, 2004).

METHODOLOGY

The study adopted a time series econometric methodology to make a valid assessment of cause and effect relationship. Several sequential econometric procedures including test for unit root, cointegration and distributed lag model were used to determine the causal relationships between the variables. The data for this study were based on quarterly time series data on inflation and building material prices. Data on inflation which is measured by the Consumer Price Index (CPI) were sourced from Central Bank of Nigeria (CBN) statistical bulletin. Twenty (20) building materials including cement block, and aggregates were selected for the study. Quarterly data on these materials were sourced from guardian newspaper and journal of the Nigerian Institute of Quantity Surveyors (NIQS) for 28 quarters from 1999 Q1 through 2005Q4. The prices of these materials for each quarter were simply summed up to form a single index number or Aggregate Building Material Price Index (ABMPI). The common base quarter for the CPI and ABMPI is set at 1999/1. The Data used for the study covers a forty three (28) quarter period i.e. from 1999/1 through 2005/4.

Operational Definition of Variables

The Consumer Price Index (CPI): This is a measure of the average change over time in the prices paid by urban consumers for a market basket of consumer goods and services. The market basket includes the price of food, clothing, shelter, fuel, transportation and medical care etc. The CPI is constructed by weighting each commodity price according to the economic importance of the commodity of interest (Samuelson & Nordhaus, 2005). The CPI is used here to represent the general level of prices or inflation.

Aggregate Building Material Prices Index (ABMPI): this is an index of the prices of building material purchased by a typical house builder. It includes major material from agriculture (wood) to extractive/manufacture (sand, aggregates cement & paint etc) and imports (electrical fixtures) used as materials for building construction. The Prices of twenty (20) building materials were used to construct the ABMPI by simply summing up their prices in each quarter. The ABMPI is used here to represent building materials price/cost index. The ABMPI is computed as follows

$$\frac{\Sigma p_t}{\Sigma p_0} x100 \qquad \text{…(1)}$$

where Σp_t is the sum of all prices of the selected building material for the study in the current quarter t and Σp_0 is the sum of the prices in the base quarter p_0. The resulting time series generated are then converted into an index number of price movement of all the selected building material by dividing with the base quarter.

Analytical Techniques and Strategy

The study adopted standard econometric procedure including unit root test, cointegration and distributed lag model to investigate the effect of price level shocks on prices of building material.

Unit Root Analysis; If the underlying stochastic process that generated a series can be assumed to be invariant with respect to time, the process or series is non-stationary. If the stochastic process is fixed in time, the process or series is stationary. Stationary series can be modeled via an equation with fixed coefficients that can be estimated from past data. Many of the time series encountered in business and economics are not generated by stationary processes. Many of the non-stationary time series could become stationary after differenced one or more times (Nelson and Plosser, 1982; Pindyck and Rubinfeld, 1991). The study applied three widely used unit root tests including; the Dickey Fuller (DF) test, the augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1979) and the Phillips-Perron (PP) test (Phillips and Perron, 1988).

Cointegration Analysis; Regression analysis based on trending time series data can be spurious (Leitner, & Fischer, 2000, Gujarati, 2003). This problem of spurious regression led to the concept of cointegration (Granger and Newbold 1974 and Granger, 1981). Two time series are said to be co-integrated, when both are non-stationary, but a linear combination of those time series will be stationary (Engle and Granger, 1987). The stationary linear combination is called the co-integrating equation and may be interpreted as a long-run equilibrium relationship between the series (Leitner, & Fischer, 2000). Testing for cointegration is a way of testing the long term relatedness between time series data. If cointegration exists between the two variables, causality must exist in at least one

direction (Granger & Newbold, 1986; Granger 1988). The Johansen cointegration test (Johansen, 1988 and 1991) is used to test for the significance of cointegration between CPI and ABMPI. The two statistics that may be used to test for the presence of cointegrating vectors are the λ_{max} and the λ_{trace} statistics. The former is for testing the null hypothesis that the number of cointegrating vectors is r against the alternative of (r+ 1), while the latter for testing the null hypothesis that the number of distinct characteristic roots is less than or equal to r against a general alternative(Tan, 2000).

The Distributed Lags Model (DLM); in time series econometric the dependence of a variable Y on another variable(s) X is rarely instantaneous. Very often, Y responds to X with a lapse of time. A regression model involving time series data that include not only the current but also the lagged (past) values of the explanatory variables (the X's) it is called a Distributed Lag Model (Gujarati, 2003). Distributed lags analysis have been used extensively in economics since their popularization by Almon (1965) and have more been employed in virtually every sphere of quantitative analysis. Thus

$$Y_t = \alpha + \beta_0 X_t + \beta_1 X_{t-1} + \beta_2 X_{t-2} + \cdots + \beta_{t-k} + u_t$$
……………………………………………….(2)

is a distributed lag model. The coefficient B_0 is known as the short run, or impact, multiplier because it gives the change in the mean value of Y following a unit change in X in the same time period. If the change in X is maintained at the same level thereafter, then (B_0 + B_1) gives the change in (the mean value of) Y in the next period, (B_0 +B_1+B_2) in the following period and so on. These partial sums are called, interim, or intermediate, multipliers.

RESULT

Unit Root Test; The null hypothesis of unit root for the series in level form with and without time trend are rejected at all conventional levels of significance. The series were then transformed into their natural logarithm and first differenced and the unit root test rerun, the DF, ADF and PP tests statistics then reject the hypothesis of a unit root at all conventional levels of significance. The LCPI was stationary without differencing i.e. 1(0) while the LABMPI became stationarity after first differencing (i.e. I (1)). Table 1, shows the DF ADF and PP test statistics on the natural logarithm of CPI and ABMPI both in level and in the first differenced forms.

Table 1 Unit Root Test

Series	Dickey Fuller (DF) level		Augmented Dickey Fuller (ADF) at 1st diff		Phillips-Perron (PP) at 1st diff		Conclusion
	Constant, no trend	Constant, trend	Constant, no trend	Constant, trend	Constant, no trend	Constant, trend	
LABMPI	-0.404139	-4.998952	-5.949550	-5.814306	-21.63541	-20.98838	I(0)
LCPI	0.069950	-2.882286	-5.246785	-5.388416	-5.246785	-5.388446	I(1)

Cointegration test; Table 2 reports the results for the Cointegration tests , the result shows that the likelihood ratio (trace statistics) rejects the null hypothesis of no significant cointegration between LCPI and ABMPI since the likelihood ratios are greater

than the associate critical values at 5%. It could be inferred that there is a long –term equilibrium contemporaneous relationship between the variables and they have a common trend. The establishment of cointegration rules out the possibility of a spurious relationship between the variables, and suggests that a causal relationship must exist in at least one direction.

Table 2 result of Cointegration test

Series	Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
LCPI & LABMPI	None *	0.547304	31.77948	25.87211	0.0082
	At most 1	0.349331	11.17359	12.51798	0.0830

Trace test indicates 1 cointegrating eqn at the 0.05 level

In testing the lagged model for the relationship between LABMPI and LCPI, two simple models i.e. model (1) without lagged and model (2) with lagged values were estimated. The resulting equation of model without lag is presented in table 3

Table 3 model 1

Dependent Variable: ABMPI				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-479.1730	54.07225	-8.861718	0.0000
LCPI	126.1515	10.86865	11.60692	0.0000
R-squared	0.838228	F-statistic		134.7205
Adjusted R-squared	0.832007	Prob (F-statistic)		0.000000
Durbin-Watson stat	1.865110			

Table 4 model 1 diagnostic tests[3]

DIAGNOSTIC TEST	p VALUE
ARCH	0.591630
BG Serial Correlation LM	0.696746
Normality	0.000045
White Heteroskedasticity	0.696746

The sign of LCPI is positive, a priori. The DW statistic indicates no significant autocorrelation, supported by the p-value for the LM test for serial correlation statistic. The diagnostic test results each indicate accepting the null hypotheses,[3] with the exception of the ARCH test, which indicates heteroscedasticity in the model.

Table 5 model 2

[3] Diagnostic Test Hypotheses:
Serial correlation (Lagrange Multiplier test) H_0: No serial correlation. H_A: Serial correlation is present.
Functional form (RESET test) H_0: Well-specified model. H_A: Model mis-specified.
Normality test (Jarque Bera test) H_0: Residuals normally distributed. H_A: Resid. Not normally distrib.
Heteroscedasticity test (ARCH test) H_0: No heteroscedasticity. H_A: Heteroscedasticity is present.

Dependent Variable: LABMPI				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.637085	0.334549	1.904309	0.0684
LCPI(-1)	0.876365	0.067494	12.98433	0.0000
R-squared	0.870863	F-statistic		168.5928
Adjusted R-squared	0.865697	Prob(F-statistic)		0.000000
Durbin-Watson stat	1.883600			

Table 6 model 2, diagnostic test

DIAGNOSTIC TEST	p VALUE
ARCH	0.790952
BG Serial Correlation LM	0.544473
Normality	0.109346
White Heteroskedasticity	0.371483

The resulting equation of model with lagged values is presented in table 5. The model fit is good adj. R^2 =87.08%. The sign of LCPI is positive a priori. Durbin Watson test indicates no significant serial correlation which agrees with the LM serial correlation test statistics. All other diagnostic tests suggest accepting the null hypotheses.
Experimentation with the addition of more lags of the independent variables i.e. LCPI was carried out and the adjusted R^2, AIC and SIC were used to determine the optimum lag model. The following final model presented in table 7 was estimated. Any further addition of the lags of the independence variables beyond two quarter lags resulted in wrong signage (negative sign of LCPI) of the independence variable which is not reasonable.

Table 7 model 3

Dependent Variable: LABMPI				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.598516	0.376264	1.590681	0.1253
LCPI(-1)	0.492174	0.509199	0.966564	0.3438
LCPI(-2)	0.394793	0.532886	0.740858	0.4663
R-squared	0.865142	F-statistic		73.77459
Adjusted R-squared	0.853415	Prob(F-statistic)		0.000000
Durbin-Watson stat	1.980181			

Table 8 model 3, diagnostic test

DIAGNOSTIC TEST	p VALUE
ARCH	0.826736
BG Serial Correlation LM	0.414942
RESET TEST	0.520032
Normality	0.094307
White Heteroskedasticity	0.824893

Model 3, a distributed lag model is a model with two lags of LCPI (i.e. -1 and -2). The model fit is high with adj. R^2 =85.34%. The sign of LCPI is positive a priori. Durbin Watson test indicates no significant serial correlation which agrees with the LM serial correlation test statistics. All other diagnostic tests suggest accepting the null hypotheses at 0.05.

DISCUSSION

The distributed lag model clearly establishes that inflation impact on prices of building materials. As a matter of fact CPI or the price level affect building material prices significantly up to two quarters (six months) after their occurrence. Evidence from the model suggest that the coefficient statistics are insignificant even when the model R^2 and adjusted R^2 indicate a good model fit. This contradictory result of insignificant coefficient and significant R^2 may not be unconnected to multi-collinearity (Gujarati, 2003) between the independent variables i.e. LCPI (-1) and LCPI (-2). This implies that two successive CPIs have similar linear movement. This finding agrees with the extant literature that inflation does drive up building material prices (Anunobi, 1997, Ofoegbu, 1998, Ojimelekwe, 1999, Jagboro & Atigogo, 2000 and Jagboro & Owoeye, 2004 etc).

CONCLUSION AND RECOMMENDATION

Price level movement or inflation affects building material prices significantly. The Price level movement in the current quarter will impact significantly on building material prices up to two quarters thereafter. The government through its regulatory institutions must provide enabling environment that stabilize price level of consumer goods and building materials. Since the single largest proportion of the Nigerian CPI is composed of foods and consumer goods efforts must be made toward the sustainable development of the agricultural sector to produce abundant foods that reduces the price volatility. Government must also develop mining, manufacturing and transportation to improve price stability in the economy. Furthermore, effort must also be directed towards reducing importation of consumer goods and building material that expose both the CPI and building material prices in foreign exchange volatility.

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TRAINING AND DEVELOPMENT OF BUILDING SURVEYORS IN MALAYSIA

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ABSTRACT

The Building Surveyor (BS) is a qualified person who performs Building Control works and other activities related to construction which involves an organised preparatory process of physical development, supervision of construction quality and Physical conditions of the building. BS plays a vital role in the building industry, especially in developed countries such as the United Kingdom and Australia. However, the awareness on the importance of BSs in Malaysia is still low. Most of the BS graduates work in various fields after they have graduated. The competencies and professional level of BS graduates has always been debated by other professionals in the building industry. Hence, the study concentrates on the academic training of BS programme in Malaysian Universities in order to determine the efficiency of the learning outcomes. Additionally, the paper also focuses on the employment trend of BS graduates in Malaysia. Triangulation approach was used in the study. From the results, it could be concluded that BS are still demanded in Malaysian building industry even without the Building Surveyor Act. In terms of training for BSs in universities, the programme structures from 3 major universities were found to have covered comprehensively the aspects of building construction, technology, maintenance and legal requirements.

Keywords: training, building surveyor, Malaysia

INTRODUCTION

A Building Surveyor (BS) should be equipped with a thorough understanding of construction techniques, building materials, methods and technology skills simultaneously with knowledge on the building significance and building regulation (Dickinson, 1999). In Malaysia, a professional BS is an eligible person, by assessment and practice, and also a registered member of the Royal Institution of Surveyors Malaysia (RISM). The Building Surveyor service has started in Kuala Lumpur Municipal Council (KLMC) since 1950's. It was the British who first introduced the Building Control department which manages the building plan submissions and other related tasks with regards to new and existing construction works. Besides KLMC, there is another local authority which employes BS like Petaling Jaya City Council

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(PJCC), Bentong Municipal Council (BMC) and Subang Jaya Municipal Council (SJMC) (Ahmad, 2003).

Although in developed countries such as in the United Kingdom (UK) and Australia the demand for BS graduates is great, so far it is not so in Malaysia due to some reasons. The profession of BS was constituted since year 1990, under the organization of RISM. Despite the long period of establishment, it is still in the process of getting recognition because the awareness level towards the significance of BS service is comparatively low. Only a few of BS graduates were employed in the government sector. On the other hand, most of the graduates are working in different fields such as property management, quantity surveying and construction sites.

Furthermore, there was an evidence of BS dating back to the 1860s in the UK with the formation of the RISM (Dickinson, 1999). Introduction of the 1961 syllabus on BS was started 10 years before BS were classed within the Royal Institution of Chartered Surveyors (RICS) as 'non-specialist members'. However, BS Division was then found to be necessary, formed by the RICS in 1973 to which the Council approved the designation *'Chartered Building Surveyor'* in 1975 (Dickinson, 1999).

DEVELOPMENT OF BUILDING SURVEYOR PROFESSION

United Kingdom was the first country which introduced BS profession. Only in United Kingdom, the BS will be given more authorised power if compared with other profession like Architect. The profession of BS had been further established and enhanced through the efforts of the Royal Institute of Chartered Surveyors (RICS). As a result, the job scope of BS were defined and identified. The area and scope of work of the BS in the context of project development and construction fields was acknowledged. Similarly, in Australia, BS are mainly involved in building control within the government agencies. Besides, BS carried out building dilapidation analysis for both new and historical buildings in private firms. In Hong Kong, BS profession is more recognised as compared to other Asian countries like Malaysia and Singapore. Comparatively, The Hong Kong Institute of Surveyors (HKIS) was already established earlier in the year 1985. There is a positive growth of the BS profession in getting recognition and acceptance as a vital position in the project development and construction industry. More than 20 years after the Building Surveying Division of RISM was formed, BS is still generally misunderstood by other professionals and the general public. BS is not just building sites and measurements. BS are also trained and qualified to advice on every aspect of the built environment and on the use of land (Dickinson, 1999). Dickinson (1999) further explained that BS is to make sure that buildings work as they were intended to, for the occupier, the landlord, the developer and the investor. Like in the UK, BS in Malaysia was originally under the General Practice Section, also known as Property Consultant Valuation Surveyors (PCVS). Even though the public had witnessed and benefitted from BS for decades in the UK, the role and skills of this profession was still not fully understood (Hashim, 1993). The public was still not aware of the existence of BS as a profession. It was even more surprising when there appeared to be a lack of understanding of the General Practice Surveyors (PCVS or BS) by some members, especially those of the other two sections (Yap, 1966).

CHALLENGES OF THE BUILDING SURVEYOR IN MALAYSIA

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There are some issues and challenges faced by the BS profession in Malaysia. These are further discussed below:

i. Public Awareness and Recognition

In Malaysian context, there is lack of public awareness on the significance for establishment of BS profession in the construction industry. The position is not commercially introduced to the public. There is less in printed article about the profession mentioned in local newspaper media and it has leaded to ignorance among the public on its significance value. The public may not realized that they will get benefit from the BS profession because the surveyors will contribute their services in term of dilapidation and condition survey on new premises, old building and offering professional justification on the building's condition and its property value (Abd-Rashid et al., 2007).

ii. Acceptance of other professional bodies

Currently, the most challenging task for the establishment of BS profession in Malaysia is the process of gaining recognition and acceptance from other specialised professions like Architects, Engineers and Valuers. Continuous confrontation against the establishment of the BS profession gave a great impact towards the approval of the draft of BS Act. Those professional actually realise the significance of BS scope of work and accountability, but they worry to compete with the BS then loss their competitive business and specific area of expertise. It has contributed to the constant objection towards the approval and implementation of BS Act. Even those professional highlighted that it is not necessary to establish and endorse the BS profession with the reason that they are equally competent with their comparable knowledge and ability as the BS profession (Abd-Rashid et al., 2007). There are negative perspectives from certain parties who feel uncomfortable with the emergence of BS practice. The role of BS is actually not in competition with other professions; instead it complements and works in harmony with them. Therefore, each profession has their own role to play for the benefit of the industry. The society and the public should be the one who is supposed to gain the maximum benefit (Ahmad, 2003).

iii. No Specific Regulated Act

Building Surveyor Act been drafted and get approved since year 2007. Numerous amendment being done to make sure that the Act will get consent and recognition from other parties such as Architects and Engineers. Yet, until today, the teams of the BS division of RISM haven't gained any approval for the Act and hence it contributed to the retard of the approved regulation. The current evolution in Malaysia show that the BS profession will be included in Engineer or Technologist acts. When the Surveyor Act 1967 was first approved in Malaysia, BS profession was placed within the General Practice Group, within the same group with another 3 surveying professions which are Valuation, Housing and Planning, whereas Quantity Surveying formed a separate group under the same Act. Nonetheless, Land Surveying is under a different Act. The Surveyor Act was revised in the year 1972, 1973, 1974, and 1989. The revision was carried out without taking the existence and needs of BS services into consideration (Ahmad, 2003).

iv. Educational standard

Abd-Rashid et al (2007) proposed that the syllabus offered of the BS course is varied in the higher education institutions and/or local universities. It has created non-standardization of specific areas of expertise and responsibilities for a BS. There is

much effort being taken in ensuring the programme of study to reach up to an acceptable level. Only local institutions are found to comply with the RICS requirements while the rest are not especially in local private institutions.

In Malaysia, there is an agency known as Malaysian Qualifications Agency (MQA) which controls and monitors quality of new programmes introduced in universities. Besides, MQA is also responsible in monitoring and overseeing the quality assurance practices and accreditation of national higher education. In designing BS programme structure, MQA plays an important role in assuring the course fulfills the set criteria and standards. In fact, the guidelines for approval by Ministry of Higher Education set by the University are modified based on the guidelines provided by MQA.

v. Slow Response for Graduate Membership

Up to October 2006, there only 216 people who are registered as members of BS Division of RISM. In fact, the number of registered members is far less than the BS graduates, either from local or foreign institutions. Based on a research finding by Universiti Teknologi MARA (UiTM), there are a number of 535 BS graduates since the Diploma programme was introduced in 1999 and Bachelor Degree programme in 1995. The scenario showed that most of the graduates from local or private institutions are not registering themselves with the BS Division of RISM (Abd-Rashid et al., 2007). The slow response from the graduate students has slowed down the endorsement process of the BS Act. The students were do not enthusiastically engage in active advocacy for the adoption of standard practices and improvement of membership. Due to this lack of enthusiasm on the part of the existing members, it has led to the public, government and private sector not taking the profession more seriously than it currently is.

vi. Slow Response From Government

The BS profession has been approved by the Malaysia Public Service Department (JPA) in 1999. The service is placed under the Scheme in ENGINEERING Classification (J) and pay scales which are comparable with other professional services as recognised by government (Ahmad, 2003). However, Abd-Rashid et al. (2007) mention about the slow response from the government organizations to ensure all state and local authorities employ the BS qualified persons in their respective departments. The BS post is only being offered in 3 local authorities (municipal and city councils) within their departments. This scenario is due to the lack of awareness within the government sector itself about the important role of BS towards the local building and construction industries. This in turn is proving a big obstacle for the Building Surveyors to get recognition from the industry.

BUILDING SURVEYOR TRAINING IN MALAYSIAN UNIVERSITIES

There are three (3) public and one (1) private universities in Malaysia that offer BS programme at the Bachelor Degree level. They are University of Malaya (UM), University Science Malaysia (USM), UiTM and Twintech International University College of Technology (TIUCT). In this research, only BS syllabus for 2 universities has been discussed. In the latest UM BS programme syllabus, there are 30 courses, but with higher credit hours (106). Compared to the second constructed syllabus, nearly all of the subjects have been reviewed and redesigned. Besides Legal Studies

which remained almost the same, the other subjects have been re-constructed in order to fit with the requirement needed for a professional BS. The programme now concentrates mainly in Building Measurement & Analysis, Development Appraisal, Building Control & Design, Building Pathology & Dilapidation and Building Conservation Studies as the hours credited in these courses are considered as high (above 4 credits). These courses provide the core theory and practical knowledge that should be acquired by a BS today. Besides the main studies, the courses such as Environmental Science, Construction and Building Services are all crucial and they enhance the ability of a BS in both construction, maintenance and management field. Not forgetting the importance of subjects like Academic Project and Industrial Training that enable the undergraduate to be exposed to a more challenging research, ethic and practical experiences.

On the other hand, the USM introduced BS programme in 2009, twelve years after the programme has been set up in UM. The programme is offered in the School of Housing, Building & Planning. The programme structure for BS programme in USM is more or less similar with that of the UM syllabus.

RESEARCH METHODOLOGY

This research was designed using qualitative approach to study the employment trend of BS graduates. It also was used to get feedback from respondents on challenges faced by the BS profession and recommendations to overcome those challenges. The questionnaire contains 3 sections as following:

i. Section A: The respondent's particulars: - Closed ended question were asked in this section because the data can be easily analysed and eased the respondents in answering the questions.
ii. Section B: The respondent's perspective on BS profession:- Questions regarding challenges of BS profession using the Likert's scale which required the respondent to rate the significance of challenges ranging from 1 (least significant) to 5 (very significant).
iii. Section C: The respondent's opinion and recommendation on the BS profession: - This section used open-ended type of questions which did not limit the respondents to only choosing available alternatives as provided by the researcher. This was to obtain feedback with varied points of view.

DATA COLLECTION AND DISCUSSION

Table 1: Cross tabulation of gender of the respondent and the job title

Job Title	Gender	
	Male	Female
Contract Executive	0	2
Project Executive	3	3
Civil Engineer	2	0
Quantity Surveyor	2	10
Site Engineer	3	0
Property Valuer	0	1
Building Surveyor	1	1
Other	4	0
Total	15	17

The findings obtained were conformed to what Abd-Rashid et al (2007) mentioned earlier. From the responses received, there was a trend that indicated that BS graduates do not work as BS after they had graduated. Majority of them were working in different fields related to the construction industry. It was found that males normally work at site whereas females preferred to work in the office after they had graduated. Refer Table 1.

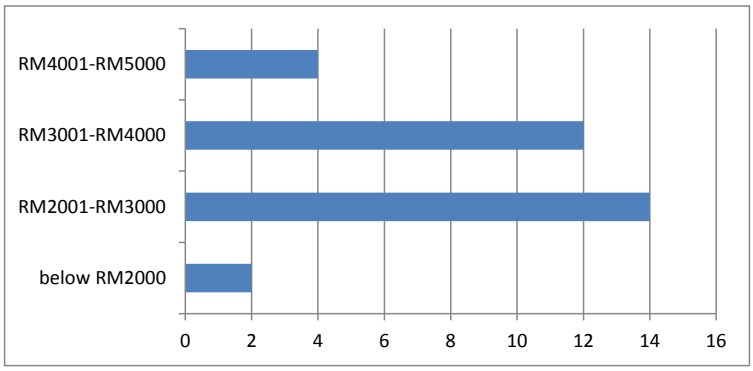

Figure 1: Salary Range for BS Graduates in Malaysia (n=32)

Figure 1 shows the salary range for the BS graduates. There were 14 respondents who answered this question, of which 43.8% who receive a monthly salary paid within the range of RM2001 to RM300, followed by 12 respondent in the range of RM3001 to RM4000 (37.5%), 4 respondents were paid RM4001 to RM5000 (12.5%) and 2 respondents were working with the salary range below RM2000 (6.3%).

Table 2: Cross tabulation of year of graduation of the respondents and the salary paid

Monthly Salary Paid	Year of Graduation of Respondent					
	2003	2004	2005	2006	2007	2008
below RM2000	0	1	0	1	0	0
RM2001-RM3000	1	1	1	0	3	8
RM3001-RM4000	2	1	0	1	2	6
RM4001-RM5000	1	0	1	0	0	2
Total	4	3	2	2	5	16

Table 2 shows the cross tabulation of year of graduation of the respondent with their monthly salary paid. From the table above, monthly salary paid for the respondents who graduated in year 2003 in the range of RM2001 to RM5000. The figure indicates that BS graduates are still able to perform very well in their working field because the salary paid is very attractive as compared with salary scale of other surveying graduates such as quantity and land surveyors.

Respondents were also asked on their response about the importance of BS in Malaysian construction industry. More than 70% of the respondents agreed that BS plays an important role in the Malaysian construction industry. The same respondents agreed that there was no other specific profession that was responsible for guiding builders on the building regulations. They further explained that BS is the person who ensures all the building control regulations are complied with during the planning and construction works of all kinds of buildings and of most property for instance extensions, refurbishments, renovations, conversions etc.

Moreover, they agreed that BS will resolve any uncertainties regarding building regulations matters. BS also undertakes site visits throughout the construction stages to ensure that the procedures are being carried out properly and in accordance with the regulations. One of the respondents had mentioned that buildings need safety and security auditing which can be carried out by BS. On the other hand, 6 respondents (18.8%) did not agree that BS is important in Malaysia. The respondents felt so because there are not many BS jobs being offered in Malaysia in the construction market.

Table 3: Responses on challenges of establishment of BS profession

Challenges	Mean	Standard Deviation	Ranking
No specific Act or regulation	3.84	1.439	1
Slow response from Government	3.78	1.263	2
Acceptance of other professional bodies	3.63	1.212	3
Entitlement of BS	3.59	1.316	4
Public awareness and recognition	3.47	1.565	5
Educational standard	3.34	.937	6
Slow response from graduate students	3.16	.847	7

Respondents further asked about the most important challenges for the establishment of the BS profession in Malaysia. Table 3 indicates the ranking on the responses received. No specific Act or regulation is the most significant challenge faced, for the establishment of BS profession in Malaysia. The results were reconfirmed as Dickinson (1999) mentioned that there will be an increase of job opportunity among the building surveyors once the BS Act is regulated. Ahmad (2003) had also pointed out that BS had struggled for years to lobby for the enactment of the BS Act since 1970s. Without the Act, BS cannot register as a professional body under the Ministry of Finance. This has restricted the BS to perform in their profession in the building control and performance field.

The second highest ranked challenge is slow response from government. It is in accordance with the view of Abd-Rashid et al. (2007) that the government is slow in ensuring BS profession is positioned at a vantage within the respective government departments. According to Ahmad (2003), the Surveyor Act 1967 was firstly approved in 1960s and later revised in the 1970s to 1980s. Yet, the revision never took into consideration of the BS professional needs. In the late 2000, the Ministry had approved and mentioned the BS Act in the Parliament but there was no immediate action taken therefore the application was left pending.

Acceptance of other professional bodies ranked number 3 out of 7 challenges. This reflects the statement made by Ahmad (2003) and Abd-Rashid et al. (2007). In the current scenario, there is a continuous argument from other professional bodies especially the Architects and Engineers. With the establishment of the BS profession, there will be someone who controls, oversees and limits their profession. They are afraid that BS will monopolise the construction market and they would lose their business and specific scope of services.

From the survey conducted, 84.4% agreed that BS can stand together with other professional job/post level in Malaysian Construction Industry now and also in the future. The respondent had mentioned that it will be possible provided Malaysian construction industry is made aware of the importance and scope of BS in building

construction industry. Moreover, BS is involved from pre-construction stage until post construction stage. BS has knowledge in planning, construction and design, combined with practical mind-set and IT skills. Some of the respondents stated that BS can stand together with other professions once it recognized by the government and with a specified Act to regulate it. Some respondents argue that BS is a vital profession in order to ensure and enhance the quality of construction in Malaysia. There will be different professions and each profession should have their own specification and specialization of work and BS is the main person to deal with building pathology and condition survey. In the absence of BS Act, there are no specific job scopes that can be claimed under the BS domain. In contrast, other professions have their respective Act to protect them.

The survey also attempted to find out the ways in which the BS profession in the Malaysian Construction industry can be enhanced and creation of awareness of the BS's role. The feedbacks received show the majority of the respondents pointed out that the government should play an important role in promoting BS profession to public or other professional bodies. The government should create more job opportunities for graduated BS in construction industry so as to make known the existence of BS. Some of the respondents proposed that starting BS course in more universities all over Malaysia will help. Moreover, the government should take immediate action in passing the BS Act. The BS Act will enable the BS in Malaysia to register themselves as a professional body under the Ministry of Finance. With the registered license, they can perform as consultants in the field of construction. . The BS Act will eventually protect the public interest by lowering the probability of building defects, abandoned projects and low building functional utility. In addition, the BS graduates should prove themselves in the construction industry and let people know that BS student multi-faceted personnel in construction management and building management. . They must prove that they are able to carry out their job and as competently as other professionals.

In the aspect of training, both universities UM and USM have used the same guidelines to design their programme structure. Generally, almost all subjects included in the course are the same with the latest syllabus in University of Malaya, except some differences in the subject titles.

CONCLUSION

They are 6 challenges being identified in the literature reviewed, faced by BS and the most significant challenge was that no specific act was passed for the profession. The study also identified that the possibility to overcome this issue was by applying a holistic approach that combined the efforts of the government, public and the BS graduates themselves to promote and pass the BS Act as soon as possible. Although in absence of the BS Act, there is still a demand for BS in the Malaysian construction industry. One of the indicators showed that the BS graduates are still able to get an attractive salary which is equivalent to other professionals such as engineers and architects.

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Comparative Study on Climate Change Acts

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Abstract:
Climate change is one of the biggest challenges facing mankind today. With the intention of mitigating climate change, a few countries have passed climate change acts. This paper compares four climate change acts in Europe: in United Kingdom, Scotland, Austria, and France. Most of the acts set a target of greenhouse gas emissions reduction for 2050. There are similarities with setting periodic or annual targets, monitoring the progress in relation to emissions reduction, and establishing a climate change committee. But the focus in the acts differs. The UK and Scottish Acts are both framework acts and consist of more of planning mechanisms than of substantive provisions of law, whereas the French Act is clear in regard to the measures on how to mitigate climate change. In conclusion, all the acts represent the national need, or the national situation at the moment, in relation to climate change mitigation. This study shows that there can be different approaches to climate change acts and the UK model is not the only choice. Nevertheless, it remains to be seen what kind of results these climate change acts can deliver.

Keywords:
Climate change act, climate change, climate law, comparative law.

1 Introduction

Climate change is one of the biggest challenges facing mankind today. With the intention of mitigating climate change, a few countries have passed climate change acts: United Kingdom (UK) and Scotland separately, Austria, France, the South Korea, Mexico, and Australia at least have legislation that can be called climate change acts. And many countries are considering of making one. What do these climate change acts in force comprise of? What kinds of targets do they set? How binding are the commitments? What is the timeline with the acts? How are they enforced? These questions are studied in this paper.

The paper is a comparative law study on climate change acts in the European Union member states that have passed climate change acts: the UK, and Scotland separately, Austria, and France. It is justified to look at the Scottish legislation since the climate acts in force in Europe are very limited and the Scottish Climate Change Act differs from the UK Climate Change Act. The comparison is limited to binding legislation; there are a number of different strategies and policies, in governmental level, about climate change mitigation but their comparison is much broader topic than this paper,

and the focus of that comparison is more in politics rather than in law. Furthermore, there is a lot of national sectoral legislation concerning climate change related issues, such as emissions trading, renewable energy promotion, and energy efficiency, but the focus in this paper is in the target-setting "general" climate change acts. In conclusion, the paper gives insight into solutions used in these countries concerning climate change mitigation.

This paper will first discuss the question of climate change mitigation on international level, European Union (EU) level, and development in some European countries. Comparison between climate change acts in selected European countries will follow then; the comparison is divided into subsections concerning important and common elements in these acts. The paper closes with linkages to the broader discussion of climate change mitigation and adaptation.

2 Development in Europe

2.1 International level

The international background to climate change mitigation is set in the United Nations Framework Convention on Climate Change (UNFCCC) adopted in 1992 (United Nations 1992). Currently, 195 parties have ratified the convention. The Kyoto Protocol to the convention sets binding targets for 37 industrialized countries and the European community to reduce their overall emissions of greenhouse gases by at least 5 % below 1990 levels in the five-year period 2008 to 2012 (United Nations 1998). The future of the global convention is still undecided, though negotiations agreed in Durban have started.

2.2 EU-level

The European Union has taken action in order to mitigate climate change: the so-called EU 20-20-20 targets consist of 1) decreasing greenhouse gas emissions by 20 % below 1990 levels, 2) improving energy efficiency by 20 %, and 3) promoting the use of energy produced with renewable sources up to 20 % of the energy consumption. The targets are set to be accomplished by 2020.

To set the 20-20-20 targets into binding legislation, the EU climate and energy package was introduced in 2009. Firstly, the package includes a revision of the Emissions Trading System (ETS). From 2013 to 2020 the ETS cuts emissions by 21 % from the 2005 level, annually by 1.74 %, among sectors it is applied to. Secondly, the Effort Sharing Decision limits emissions from non-ETS sectors, such as transport, housing, agriculture and waste. The overall EU target for emission reduction in the non-ETS sector is 10 % below the 2005 level which is divided into binding national targets. Thirdly, by the so called RES-directive, the use of energy from renewable sources is raised to 20 % of overall EU energy consumption by the year 2020, a target which is also divided into binding national targets. And finally, the package includes a legal framework to promote the development and safe use of carbon capture and storage (CCS) (EU 2009).

Furthermore, in trying to boost the international climate change negotiations, the EU has made a conditional offer to raise its target for 2020 emissions reduction from 20% to

30% if “a global and comprehensive agreement” is reached. Additionally, the EU aims at 80 to 95% reduction in EU emissions by 2050 compared to 1990 and suggests this target for other developed counties, too (EU 2009). For clarity, it must be stated that this target is not legally binding.

2.3 Member States

The UK has led the way in putting the climate change targets into binding legislation: the UK Climate Change Act was passed in 2008 and has been an example for later climate change acts. The following year Scotland passed a more detailed act to be applied in addition to the UK Act: the Climate Change (Scotland) Act 2009. Understandably, the Scottish Act looks very similar to the UK Act. In France, the regulation concerning climate change has been developed as part of the revision of the environmental legislation since 2007; the two-staged reform is called Grenelle 1 (2009) ja Grenelle 2 (2010). The most important output of Grenelle 1, in climate change point of view, is an “environmental program act” (Loi n° 2009‑967 du 3 août 2009 de programmation relative à la mise en oeuvre du Grenelle de l'environnement), that coordinates legislation. The first part of this act embraces climate change mitigation and can be referred to as the French Climate Change Act. The latest climate change act has been passed in 2011 in Austria, Bundesgesetz zur Einhaltung von Höchstmengen von Treibhausgasemissionen und zur Erarbeitung von wirksamen Maßnahmen zum Klimaschutz (Klimaschutzgesetz - KSG).

In summary, in the EU, there are four climate change acts in force: the UK Climate Change Act, the Scotland Climate Change Act, the French Climate Change Act (Loi n° 2009‑967 du 3 août 2009 de programmation relative à la mise en oeuvre du Grenelle de l'environnement, part 1, and the Austrian Climate Change Act (Klimaschutzgesetz). Additionally, Slovenia is well on the way of passing a climate change act but apparently the draft Climate Change Act has not yet been adopted by the National Assembly (Slovenia 2011).

2.4 Finland

The Finnish Government has drawn up a report of climate and energy politics aiming at low carbon future. In the report, Finland is envisioned as cutting emissions at least by 80% from the 1990 level, as part of international cooperation (Finland 2009). The 2011 Government platform calls for a study about whether passing a climate act is needed (Finland 2011). The study, which includes some outlines of possible act, has just been published (Ekroos and Warsta 2012).

3 Comparison between the Climate Change Acts in Europe

3.1 Overview of the climate change acts in this study

The UK Climate Change Act is extensive and generates procedures related to climate change mitigation. The act sets a target for the reduction of greenhouse gas emissions by 2050 and introduces a system of carbon budgeting to meet the target (Part 1). Additionally, a Committee on Climate Change is established as an expert body (Part 2). The Act enables the establishment of trading schemes in order to reduce greenhouse gas emissions (Part 3) and schemes for producing less domestic waste and promote

recycling, and their financial incentives (Part 5). Additionally, there are provisions about adaptation to climate change (Part 4).

The Scotland Climate Change Act sets targets for the reduction of greenhouse gas emissions: a target for 2050 and an interim target for 2020 as well as provides for annual targets (Part 1). There are provision on the Scottish Committee on Climate Change (Part 2), reporting (Part 3), and adaptation to climate change (Part 5) as there are in the UK Act. Additionally, the act sets duties to public bodies and stipulates about land use, energy efficiency, and waste reduction (Part 5).

Like the UK and Scotland Acts, the Austrian Climate Act is a framework act by its nature. The act has provisions about negotiations for drawing up the measures to share the emissions reduction target (section 3), national climate committee and advisory board (sections 4 and 5), and progress report (section 6). However, this act does not stipulate new national obligations but focuses on clearer distribution of liability between the federation and the states, and creating framework for negotiations to ensure the planning and implementation of climate politics. Nevertheless, the act is surprisingly short with its 9 sections and two annexes.

The French Climate Change Act encompasses general framework for planning and substantive provisions of law concerning in the same context. The act sets general objectives for climate change mitigation (section 2). Additionally, the act has many substantive provisions of law which aim at mitigating climate change; there are provisions about reduction of energy consumption (sections 3-6 and 18-21), spatial planning (section 7), transport (sections 10 ‑ 17), and sustainable development related research (section 22). These provisions together with the legislation in Grenelle 2 package aim at greenhouse gas emissions reductions in non-ETS sectors, which is regulated separately.

3.2 Target for 2050

Of the four climate change acts subject in this comparison, three include a target for 2050: the UK, Scotland and France. Both the UK and Scotland Climate Change Acts set a target of at least 80% lower carbon account for 2050 than in 1990. In this connection, the carbon account refers to actual greenhouse gas emissions of that year/time period plus appropriate credits and debits. The UK Climate Act enables amending the 2050 target under strict conditions, such as significant development in scientific knowledge about climate change or European or international law or policy. The French Climate Change Act stipulates the target for 2050 in a slightly different way: the greenhouse gas emissions must be limited into one fourth of the 1990 level by year 2050 that is a 75% reduction. Additionally, the 2050 target is stated numerically in the French Act, too: annual emissions must be reduced to less than 140 million tons of carbon dioxide equivalent. The Austrian Act does not set a target for 2050.

Moreover, the Scottish Act sets an interim target for year 2020 which limits the emissions account to 42% compared to the baseline year 1990, and interim target includes a possibility of modification of the percentage under strict conditions. The UK Act also sets an objective for 2020, although not as highlighted as in the Scottish Act, that is 26% lower than in 1990. The French Act repeats the EU-wide binding target of

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20% emissions reduction for year 2020, unless the EU tightens the objective up to 30%. A little bit differently, the Austrian Act repeats the EU-objective for emissions reduction in non-ETS sectors which national target set for Austria is a 16% reduction compared to year 2005. Naturally, these numbers are not comparable as such since the baseline year is different.

The targets for 2050 in the three acts are quite similar and in line with EU-vision of the long-term development towards a low-carbon economy; the French target is not stated as strongly as the UK and Scotland targets which are in a highlighted position in the acts. The Scottish interim target is clearly more ambitious. Austria has left the targets to be set later after negotiations. This way the Austrian Act differs from the other acts.

3.3 Timeline in planning

There are different approaches in dividing the each long-term target in question into shorter periods. The UK sets for five-year-periods ("budgetary periods") an amount for the net UK carbon account (the "carbon budget"). The budgetary periods including year 2020 or year 2050 must be set to meet the 2020 or 2050 targets. The carbon budgets until 2022 have been set in 2009 and for later periods every 12 years before the beginning of that period.

In Scotland, the planning is annual and linear; the target is set for every year from 2010 to 2050 and every succeeding year the target is not higher than the year before. The annual targets for years from 2010 to 2022 must have been set in 2010; respectively, years 2023–2027 in 2011, years 2028–2032 in 2016, years 2033–2037 in 2021, years 2038–2042 in 2026, years 2043–2047 in 2031, and years 2048–2050 in 2036. The annual targets must be set in consistency with the 2050 target and the interim target. The Scottish Ministers must set the targets by order that is in secondary legislation. The target-setting process and modifying the annual targets are stipulated thoroughly in the Act.

In the Annex of the Austrian Act, the maximum levels of greenhouse gas emissions are shared to sectors for the commitment period 2008 to 2012. The sharing after 2012 must be negotiated separately, in compliance with the provisions set for the negotiations in the Act. The planning is set for commitment periods, the first which is from 2013 to 2020. The negotiations begin one month after a proposal from the relevant Minister and must be completed within nine months before the beginning of the period. The outcome of the negotiations will be binding and the measures must be implemented promptly.

In the UK and Scottish acts, the annual or period based targets must be set well, at least 12 years, ahead whereas the Austrian 9 months is significantly shorter time. This has to do with predictability. Furthermore, the Austrian planning is not set as far for the future as the UK/Scotland but leaves the continuation after 2020 open. The French Act requires annual average emissions reduction target of 3% but does not set other general periodic targets than the target for 2050. In this perspective, the French approach differs clearly from the other climate change acts.

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3.4 Measures to reach the target

In UK, the act sets the Secretary of State an obligation to prepare proposals and policies to reduce the greenhouse gas emissions to meet the carbon budgets (section 13). The nature of the proposals and policies is left open. However, the act confers powers to relevant national authority to establish trading schemes relating to greenhouse gas emissions (section 44); in particular, activities of energy consumption, use of energy-consuming material, waste management of energy-consuming material, and "the production or supply of anything whose subsequent use directly causes or contributes to greenhouse gas emissions". The last definition is broad.

The Scottish Act requires the public bodies to act in a way that contributes to the reaching of the targets (2050, interim and annual targets) (section 44). Moreover, the act confers powers to make provision about energy efficiency of buildings, both non-domestic buildings and living accommodation, including provision enabling council tax discounts (part 5, chapter 3).

The French Climate Change Act (section 2) names as primary measures to mitigate climate change lowering the energy consumption of buildings and reducing greenhouse gas emissions from the transport and energy production. The cost of greenhouse gas emissions is directed to be incorporated in the pricing of goods and services by means of improving consumer information, adopting new legislation, extending ETS to new sectors, and auctioning allowances. Also, taxation measures are presented in relation to what is called "climate-energy". Additionally, as possible measures are mentioned restrictions for import from countries that refuse to bear their responsibility in climate change, economic incentive schemes, and public funding. Moreover, sections 3 to 22 stipulate sectoral targets in mitigating climate change, in the fields of energy consumption, spatial planning, and transport. For instance, the energy consumption of all new public buildings is limited to 50 kWh/m2 after the end of 2010 (section 4).

The Austrian Act refers to energy efficiency, promotion of renewable energy production, energy efficiency in the building sector, integration of climate change in spatial planning, mobility management, waste prevention, protection and enhancement of natural carbon sinks, and economic incentives as possible fields to be taken into account in the negotiations for setting the measures.

The UK, Scotland and Austrian acts only refer to possible sectors which can be subject to measures in order to reach the targets set in the acts (2050, interim and periodic/annual targets). In the French Act, the measures are shown in the act itself, making the legislation integrated and transparent.

3.5 Monitoring

The UK Act requires annual statements on the UK emissions and additionally final statements for budgetary periods, and a final statement for 2050 (sections 16, 18 and 20); the statements will be presented to the Parliament. Also, the Scottish Act calls for reporting to Parliament on annual basis (part 3). In the UK and Scotland acts, there are detailed provisions on how the reporting must be presented. Additionally, the Austrian act provides for an annual report (Fortschrittsbericht) about the progress of greenhouse gas emissions; the report must be structured by sectors (section 6). Moreover, the

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French Act calls for annual reports to the Parliament on the implementation of the commitments under the Act and their economic impacts.

In short, annual statements to Parliament are required in all the acts.

3.6 Climate change committee or other

In the UK, a Committee on Climate Change has been established. It advices on level of 2050 target, advices in connection with carbon budgets, advices on emissions from international aviation and international shipping, reports on progress, and provides advice or other assistance on request (sections 33-38 of the UK Act).The Committee consists of a chair plus 5 to 8 members. Schedule 1 to the UK Act stipulates the operating of the Committee. Additionally, the Scottish Act enables the establishment of a Scottish Climate Change Committee which advices on annual targets, reports on progress towards targets, and provide advice or other assistance (part 2). The composition of the Committee is the same as in UK.

According to section 4 of the Austrian Act, a national climate committee (Nationales Klimaschutzkomitee) should be established. The committee evaluates the fundamental questions of Austrian climate politics. In particular, the committee should take part in drafting the climate strategy for commitment periods, with which strategy the foundation is set for emissions reduction targets to be shared to sectors. Additionally, the committee should draft long-term scenarios for promoting energy efficiency and energy produced with renewable energy sources, and development towards a low-carbon economy. Moreover, the Austrian Act requires setting of a national “climate advisory council” (Nationaler Klimaschutzbeirat) that gives the committee advice (section 5). However, the French Act does not stipulate about a climate change committee or other advisory organ. This does not necessarily mean that such a committee has not been established.

The climate committees in the acts play an important role, in particular in setting the annual or periodic targets. Additionally, for instance in the UK Act, in relation to amending the 2050 target, the advice of the Committee on Climate Change must be taken into account (section 3).

4 Conclusions

The four European climate change acts approach very differently the same challenge of climate change mitigation. Still, there are many similarities, too. Three out of four acts set a target for 2050 for reduction of greenhouse gas emissions. There are provisions on setting periodic or annual targets, monitoring the progress in relation to emissions reduction, and establishing a climate change committee. But the focus in the acts differs.

The UK and Scotland Climate Change Acts set a clear target for 2050 and a system of setting periodic or annual targets to reach the 2050 target. The amending of these targets is strictly regulated in the acts; it is more difficult to amend these targets than to amend other legislation. This seems to be an interesting special arrangement. The UK and Scottish Acts are both framework acts and consist of more of planning mechanisms than of substantive provisions of law.

As for the French Act, of the 22 sections related to climate change in the act, only one (section 2, greenhouse gas emissions reduction target etc.) stipulates of the same kind of core topics as the other climate change acts in this study. The other 21 sections are substantive provisions of law and set sectoral targets in various topics under climate change mitigation. The French Act seems clear in regard to the measures on how to mitigate climate change. There are elements and targets of sectoral legislation put together in the same act, and therefore, the French Act together with Grenelle 2 can be characterized as transparently integrating legislation.

The Austrian Climate Change Act can be seen as an example of a federal state's characteristics of liability distribution which is in the focus of the Act. Otherwise the Austrian Act could be characterized as lacking ambition since the target and the measures have been shifted to be dealt in separate negotiations.

In conclusion, all the acts represent the national need, or the national situation at the moment, in relation to climate change mitigation. On one hand, it is hard to evaluate these acts separately from other related legislation. On the other hand, comparing the whole climate change legislations in different countries would be very complicated. In addition, "climate change act" as a concept is unclear. This study shows that there can be different approaches to climate change acts and the UK model is not the only choice. Still, the UK model is strong and sure to have an influence on future national climate change acts. It has to be kept in mind that from various legal reasons, e.g., in Finland, because of constitutional restrictions, many aspects of the UK model cannot be copied as such. Nevertheless, it remains to be seen what kind of results these climate change acts can deliver.

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Harnessing Marine Renewable Energy from Poole Harbour: Case Study

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Abstract:
Global warming and its impact on our environment, society, economies and security is one of the fundamental concerns of our time. In response, the United Kingdom government has put in place a legally binding target of an 80% reduction in greenhouse gas emissions on 1990 levels by 2050. The United Kingdom will need to achieve a tenfold expansion of energy supply from renewable sources by 2020 to meet its share of the European Union renewable energy target. The marine and coastal environment's renewable energy potential in Britain is high. It is estimated that it has 50% of the tidal energy, 35% of wave and 40% of wind resources in the European Union. Use of geothermal resources using heat pump technology is the least evolved sector, but in 2010 contributed to 0.7 TWh of energy and it is believed that non domestic heat pumps could contribute up to 22 TWh by 2020. In the Southwest of England, Poole Harbour has been recognised as a potential, highly predictable source of tidal and heat energy. Local groups are embarking on a feasibility study for harnessing this energy for the benefit of the community. The purpose of this article is to examine the potential conflict of interest between the laudable aims of promoting the use of renewable energy and of safeguarding ecosystems and their biodiversity. Using Poole Harbour as a case study, it will consider the environmental and economic costs and benefits of a Community Renewable Energy project (the Poole Tidal Energy Partnership) in the context of an area subject to a number of statutory and non-statutory designations to protect nationally and internationally important habitats and species. The paper identifies key environmental legislation, including spatial planning law and policy, which will facilitate exploring whether there is potential for reconciling what may be perceived as competing objectives for sustainable development.

Keywords:
Community, Economics, Environmental Law, Renewable Energy, Spatial Planning

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1 Introduction

The global commitment to renewable energy and energy security stems from the application of Bentham's utilitarian philosophical perspective of "the greatest good for the greatest number" (Presnell, 1996 and Bentham, 1789). By securing energy obtained from naturally occurring elements within the biosphere, e.g. from the sun, the wind and the oceans, we are attempting to prevent further deterioration of natural and cultural resources. In doing so, we are aiming to pass on to our descendants a better world, or at least in as good condition as the one we ourselves inherited (Weiss, 1984). This perspective was supported by Brundtland who stated that future development crucially depends on the long term availability of energy "in increasing quantities from sources that are dependable, safe and environmentally sound (Brundtland Report, Chapter 7, 1987). However the report recognised as well, that harmful ecological transformation may occur as a consequence of the technology required to harvest natural sources, citing as an example the problems encountered in hydropower where hydrodams block paths for migrating fish (Brundtland Report, 1987).

The precautionary principle 15 of the Rio Declaration 1992 (Rio Declaration) addresses this danger by suggesting a positive obligation on regulators to act to prevent the materialisation of health or environmental risks, despite the lack of scientific certainty over the nature or extent of the ecological transformation. The existence of scientific uncertainty should become a trigger for precautionary measures, and for 'reversing the onus of proof' so that proponents, rather than regulators, bear the burden of demonstrating that there is no need for regulatory action (Peel, 2004).

The European Union (EU) and the United Kingdom (UK) have adopted the precautionary principle as one of their guiding environmental policies. The UK Climate Change Policy introduced this principle with legal, economic and technological enabling mechanisms to reduce green house gases in the UK (Jordan and O'Riordan, 1995). Following recommendations from the UK Committee on Climate Change, the Department of Energy and Climate Change (DECC) has put forward policies to achieve 30% of electricity generation from renewable sources by 2020 (DECC, 2012), aiming further than the EU 15% target. To meet these targets the DECC has indicated that 7.5% needs to be delivered from local sources (DECC, 2012). In response to this, local authorities are embarking on their own strategies to achieve these objectives.

One such strategy has been approved in the southwest of England between Dorset County Council, the Borough of Poole Council and Bournemouth Borough Council. This strategy is known as the *'Renewable Energy Strategy to 2020'* (Dorset Energy Partnership (DEP), 2012) and aims to harness viable renewable energy resources to maximise local economic, environmental and community benefits (DEP, 2012).

Poole Harbour is the one of largest natural saltwater harbours in the UK. It represents a highly predictable tidal and heat energy potential that has prompted local interest in investigating the possibility of harnessing it for the benefit of the area through community schemes (Cooling, 2011). At the same time, Poole Harbour has a variety of marine, freshwater and terrestrial habitats which, together with surrounding Areas of Outstanding Natural Beauty, are subject to a number of statutory and non-statutory designations. The proposal to harness marine renewable energy from Poole Harbour will provide an insight into the different challenges faced by Community Renewable Energy(CRE) schemes.

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These include ecological, legal, economic and planning issues that need to be factored in order to achieve climate change mitigation without loss of biodiversity.

2. Community Renewable Energy projects

Alternative methods of energy production are available on both large and small scales (Miller, 2006). However, it is considered that small scale, community based renewable energy schemes are better able to meet the precautionary principle (Poladitis et al., 2006). It has also been proposed that small scale schemes are more likely to fit in with the doctrine of sustainable development, as local interested parties will use their understanding of local needs and their natural environment to propose sensible precautionary measures (Dincer, 2000). From their agreeance with the precautionary principle and the principle of sustainable development, it can be argued that CRE projects are an innovative and successful way to supply energy to homes and businesses on a small scale with a range of associated benefits for local people and ecosystems (Rogers et al., 2012). Although this concept is not particularly new, with a few communities beginning to adopt this ethos from the 1970s (Walker, 2008), it is in more recent years that interest has risen in CRE as a way to produce energy with much reduced environmental cost. This wider interest, together with the advances in technology to generate secure and financially viable renewable energy, has led to a significant increase in the number of community driven projects (Department of Trade and Industry, 2000). The aim is to provide locally based, renewable, secure energy supplies with an emphasis on community participation, ownership and a green ethos (Rogers et al., 2012).

As each community and locality differs from the last, there is no set framework or protocol for CRE projects (Rogers et al., 2008). Each one is unique, according to site, community vision and choice of technology (Shackley and Green, 2005). Nevertheless, common features amongst these schemes are: the existence of a set of values shared by all involved and that, according to research on public perceptions, local communities find these projects desirable (Rogers et al., 2008).

2.1. The Poole Tidal Energy Partnership: background and technical detail

The Poole Tidal Energy Partnership (PTEP) was formed on 4th November 2011 in response to local policies on renewable energy (Email from Hadley 2012). This partnership, with participants from the Borough of Poole, Transition Town Poole and Bournemouth University, combines local knowledge, community representation and technical expertise to form a single organisation focussed upon driving forwards the vision of a local, secure and green energy supply. PTEP's aim is to provide renewable energy at affordable prices to local residents whilst encouraging a high degree of community participation in the project.

PTEP initially proposed to employ underwater turbine technology to power a water source heat pump system that could provide heat energy to residents living within the immediate area (Stanford, 2012). However the tidal current prototype generator was ruled out because the depth of the water in Poole Harbour (1 – 5 m) did not meet the requirements for cost-effective power generation (20-30m) (Turnpenny et al., 1995 and Dorset Energy Partnership (DEP) 2012). It was then suggested that a Water Source Heat Pump (WSHP), without the turbine technology, might be the most viable technology for

this harbour. This could be implemented either as a closed or open loop system (Email from Hadley 27 July 2012) and both are currently under consideration.

A closed loop system (see figure 1) employs a fluid (food grade glycol and water mix) that circulates within a submerged coil of flexible pipework which absorbs energy from the surrounding water (Forsen, 2005). A sufficient depth is required to prevent freezing around the pipework and any damage from passing marine traffic (Kensa Engineering Ltd, 2009).

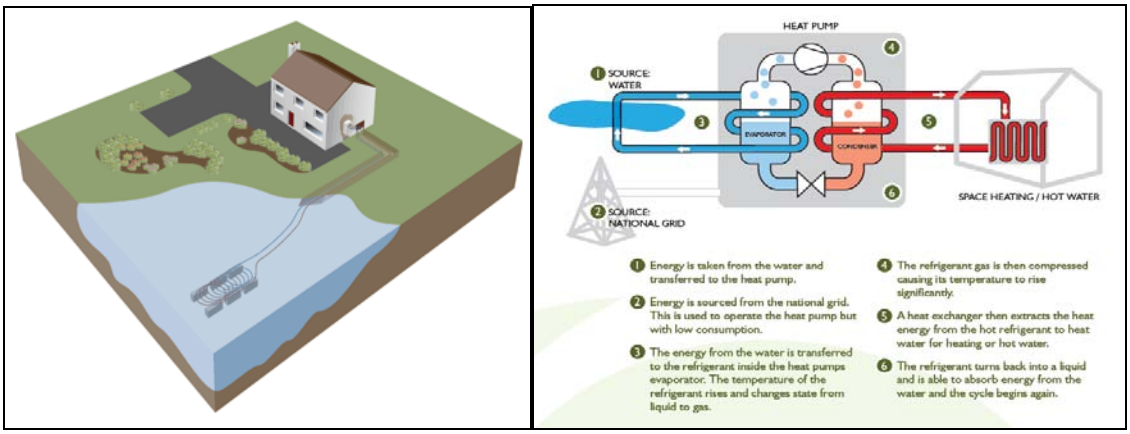

Figure 1: Closed Loop water source heat pump (Source: Forsen, M. 2005.)

An Open source system (see figure 2) draws in water out of the harbour, passing it through the heat pump and then discharges it back into the harbour (Forsen, 2005). This brings into consideration associated issues of corrosion, filtration, extraction and possible freezing within the heat exchanger (Forsen, 2005).

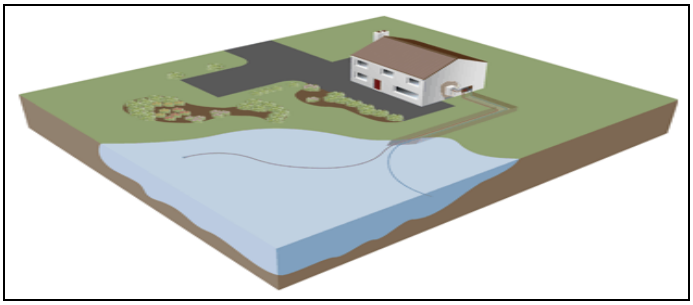

Figure 2: Open Loop heat pump (Source: Forsen, M. 2005)

3. Economics

As both a fundamental concern to both society and the principle of sustainable development, it is important for the scheme at Poole Harbour (along with all CREs) to consider the economic benefits and disadvantages of development. The UK Renewable Energy Roadmap sets out actions to help meet the above mentioned targets to generate energy from renewable sources and focuses on eight different technologies which “have

either the greatest potential to help the UK meet the 2020 target in a cost effective and sustainable way, or offer great potential for the decades that follow" (DECC, 2011a).

The eight technologies identified are: onshore wind, offshore wind, marine energy, biomass electricity, biomass heat, ground and air source heat pumps, and renewable transport (DECC 2011). Government Ministers believe that the UK has "the best wind, wave and tidal resources in Europe" (DECC, 2011a). Significant opportunities exist for the UK to make the most of its island geography and harness the power of its coastline in the production of low carbon energy.

In November 2011, the Government launched the Renewable Heat Incentive (RHI) scheme to provide "financial support to non-domestic renewable heat generators" (DECC 2011b). This seeks to provide a twenty year income stream to those who install a system covered under the scheme with the aim of making renewable heat an attractive commercial option. Renewable heat is simply any heat generated from a renewable source and will include the use of ground and water (marine) source heat pumps.

Gazo et al (2011) identify heat pumps as being the largest worldwide application for direct use geothermal energy, with worldwide utilisation in 2010 of 214,780TJ/yr (59,632 GWh/yr). The Government has set aside £680m for use between 2011 and 2015 to fund the RHI scheme (DECC, 2011b), with the amount payable to each scheme being dependent on the amount of heat generated. Non-domestic heat generation would include schools, businesses, hospitals and district heating schemes.

An international example of non-domestic, direct use, marine-source heat pumps can be seen off the coast of Sundsvall, Sweden, where the organisation Permobil AB. has laid 5000m of looped piping on the sea bed. This pipework links to four 30kW heat pumps, sufficient to provide heating for 3,300m2 of the organisation's facilities with only an occasional need for "top-up" power (NIBE, 2012).

In the UK, the National Trust is currently working with Bangor University to investigate the possibility of using marine-source heat pump technology to reduce the energy costs of the mansion Plas Newydd on the Isle of Anglesy (Jones, 2011). The proposed installation of a large scale closed loop system on the bed of the Menai Straits off the coastline has the potential to save £65,000 p.a. (Guardian, 2012).

Within Poole Harbour the opportunities for direct use geothermal energy production are currently being explored, through the use of marine-source heat pumps in a number of locations, to provide heat to a number of sites, which may be eligible for government support under the RHI.

The potential locations that have been identified are as follows:

a) Sterte Court – (Poole Housing Partnership flats)
b) Upton Country Park - (tearooms rather than main house)
c) Hamworthy Schools – (Carter Community, Hamworthy First and Hamworthy Middle)
d) Rockley Park (caravan park and communal buildings)
e) Hamworthy Library (potentially this and other local buildings)
f) RNLI headquarters.
g) Poole Harbour Redevelopment area

It is proposed that these sites may be suitable for the direct use geothermal energy produced via either closed or open loop water source heat pump systems.

Whilst there are planning and environmental concerns regarding such development in Poole Harbour, economic considerations must feature strongly in any analysis regarding the viability of such a project.

A series of evaluation methods could be employed to appraise the merits of the proposed Poole Harbour scheme. Cost/Benefit analysis incorporating Net Present Value (NPV); Internal Rate of Return (IRR) or Payback analysis could be employed to assess financial viability. When using discounted cash flow techniques (DCF) such as NPV and IRR, future cash flows are discounted (using an appropriate discount rate) to present value. This allows comparison between alternative options and those producing a positive NPV classed as financially viable.

The first issue would be in determining an appropriate discount rate, as previous large scale energy projects (such as evaluations of the Severn Tidal Barrage scheme or proposed nuclear development within the UK) have produced wide ranging forecasts resulting from assumptions over the discount rate (Ginige et al., 2011). The standard Government approach in the UK is to use 3.5% (HM Treasury 2011) for evaluating projects requiring central government funding. However, for projects requiring private finance, example 10% discount rates have been applied (DECC 2010) but in reality, private investor's own cost of capital would determine overall viability.

A typical NPV analysis may offset discounted monetised costs and benefits against each other to provide the 'net' result. The question arises of the monetised costs to be included in such analysis.
Kavanaugh et al (1995) cited Gazo et al (2011) breaks down the cost of a direct use geothermal heat Pump system. The capital costs, which for many renewable (or low carbon) energy projects are the most expensive element, consist of:

a) Ground loop = up to 34% of cost
b) Heat pump = up to 30% of cost
c) Indoor installation = up to 21% of cost
d) Ductwork = up to 15% of cost
e) Pumps = up to 7% of cost

Gazo et al (2011) suggest that although capital costs are higher than most other forms of conventional heating, low operational costs result. In addition, the type of system used can affect the capital costs. A vertical closed-loop system will require pipework to be drilled underground and therefore becomes far more expensive than a horizontal loop system (which requires no drilling). However, although a closed loop horizontal system may have 50% lower capital costs, Gazo et al (2011) explain that "for large installations, it may be impossible to find adequate areas for the installation".

A site such as Poole Harbour, given the size and flat nature of the harbour bed may be suitable for horizontal loop systems and therefore allow localised heat generation to be gained at a reduced capital cost, alongside the benefits of lower operational cost.

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In addition to capital, operational and maintenance costs, the level of compensation for the habitat affected will potentially need to be factored into the calculations. As an indication of this cost, compensatory habitat was provided for at £72,000/ha during the Feasibility Study for the Severn Barrage (DECC 2010). Furthermore, costs of mitigating undesirable environmental effects may need to be considered.

These costs could be offset against key monetised benefits, which may include the "avoided capital investment in other technologies and avoided running costs of other technologies" (DECC 2010) or the potential savings in energy costs, which Gazo et al (2011) report as being between 30% to 60% for domestic systems. Further economies of scale may result for larger scale non-domestic systems.

Energy cost savings will in part be affected by the efficiency of the heat pumps. Gazo and Lind (2010) explain that this efficiency is measured by the Coefficient of Performance (COP). The COP measures the amount of energy produced by the heat pump in heating mode, divided by the amount of energy required to drive the heat pump (Gazo and Lind 2010).

$$COP = \frac{\text{Heat Capacity (kW)}}{\text{Electric Power Input (kW)}}$$

The heat pumps to be used in Poole Harbour are expected to have a very efficient COP of 5:1.

When evaluating such a project purely from an investor perspective, giving consideration only to direct, monetary values, Woodruff (2007 p.18) states that "a project is financially viable when a project's revenues exceeds its costs". However, Woodruff (2007) contrasts this with an economic approach, where both direct and indirect, monetary and non-monetary costs and benefits are considered. Clearly, economic analysis from a societal perspective provides a much wider scope of factors to be considered and may lead to contrasting results. Using this economic approach, Woodruff (2007) advises "the project with the greatest net benefits should be chosen among all technologically feasible options for providing electricity….".

Considering an economic approach to the evaluation of renewable energy projects, key non-monetised costs and benefits may need to be incorporated into the analysis. However the difficulty here is that these are difficult to quantify. Air or noise pollution during construction may be a consideration but perhaps the greatest non-monetised cost is the potential effects on the ecosystem within the harbour and beyond. The impact on and valuation of ecosystem services is a consideration which must form part of the appraisal of future energy projects in general and especially in a project where the site is as significant as Poole Harbour. These non-monetised costs may be countered by non-monetised benefits, such as macroeconomic benefits for the UK as a whole (DECC 2010) through the use of renewable energy and contribution towards EU energy targets. However, whether on balance this leads to a net benefit, and to whom, is the subject of

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much debate, and is dependent on the valuation of these non-monetised costs and benefits.

4. Poole Harbour Ecology

As noted, Poole Harbour is an area of significant environmental importance. In order to appreciate the impact that the PTEP project in Poole Harbour, an understanding of the geological features and ecological importance of the area is imperative.

Poole Bay is a drowned valley (ria) that was formed at the end of the last ice age. The bay is an estuary formed from a number of rivers, the largest of which is the River Frome, and is surrounded by shallow creeks and islands (Humphreys and May,2005). Poole Harbour, located to the west of Poole Bay, is one of the largest natural harbours in the UK, and which has a shallow water depth of approximately 1 to 5 metres. The depth of the bay is between 5 and 20m and has a gradually shelving sandy bottom (Turnpenny et al., 1995). Its micro-tidal regime results in the retention of a significant body of water throughout the tidal cycle; with a spring tide range of 1.8m and a neap tide range of 0.6m. Twice a day, between "30,400 to 45,000 cubic metres of water enters and leaves Poole Harbour", offering huge potential for the implementation of marine renewable projects (Cooling,2011). Another relevant feature of the Harbour is the unique inter-tidal habitats which have resulted in the area being internationally important for populations of breeding and migratory bird species (Herbert et al., 2010).

The Harbour is a heavily utilised and managed site covering an area of approximately 3600ha (Humphreys and May 2005), with the densely populated north side of the harbour serving the town of Poole (Poole Harbour Aquatic Management Plan 2011). There are local management schemes that aim to keep disturbance in the area to a minimum, particularly in bird sensitive areas between Studland Bay, at the entrance of the Harbour, and Keysworth Point, to the west (Poole Harbour Aquatic Management Plan, 2011). The Poole Harbour Aquatic Management Plan, overseen by the Poole Harbour Steering Group, advocates zoning, as shown in figure 3, to "assist in the reduction of disturbance to environmentally sensitive areas". The plan's main objective is "to promote the safe and sustainable use of Poole Harbour" whilst balancing the competing demands of user groups (Poole Harbour Aquatic Management Plan, 2011).

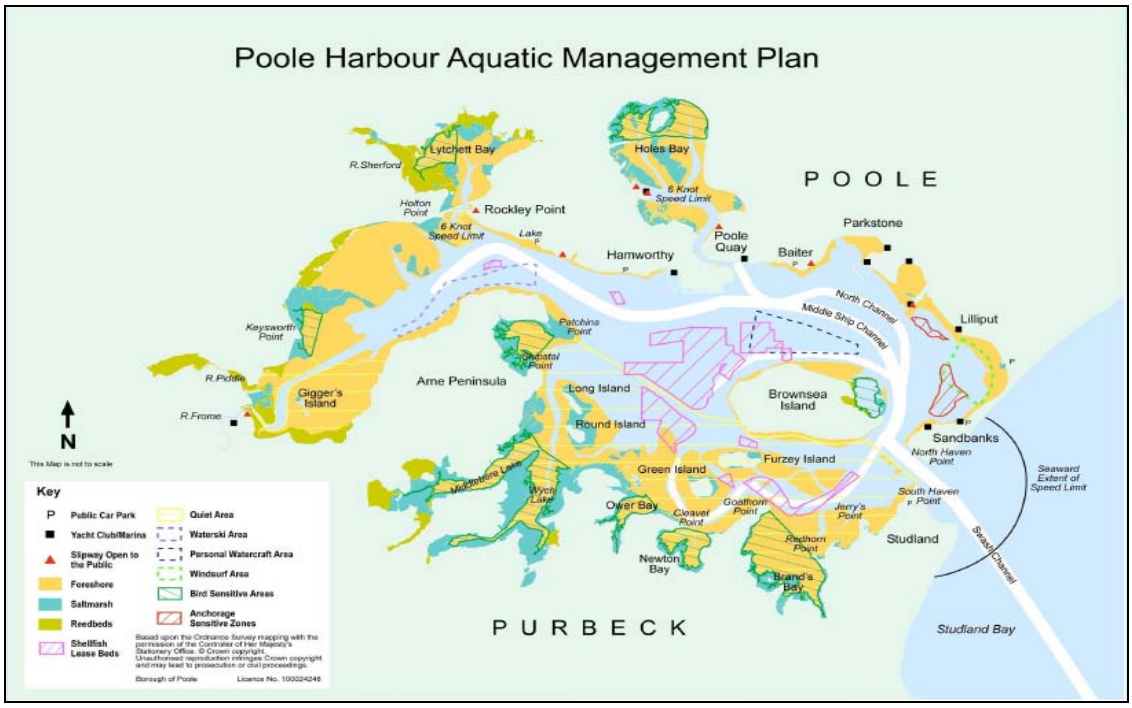

Figure 3: Map Showing Poole Harbour, Recreational activity zones (source: Poole Harbour Aquatic Management Plan, 2011)

Due to the variety of important marine, freshwater and terrestrial habitats of conservation interest located within Poole Harbour, the area is subject to a number of statutory and non-statutory designations (Marine Management Organisation (MMO), 2012). As an internationally acclaimed site for avifauna, supporting populations of birdlife year round, the intertidal mudflats, reed beds and salt marshes bordering the harbour are important feeding and breeding sites for these species (Natural England 2010). The harbour supports internationally significant populations of black-tailed godwit (*Limosa limosa)* and large numbers of dunlin (*Calidris alpine)*, redshank (*Tringa tetanus)* and curlew (*Numenius arquata)* (Durrell et al., 2006). In addition, a number of islands are located within the harbour: Brownsea Island and lagoon, Long Island, Furzey Island, Green Island and Round Island. They all provide habitat for a diversity of coastal and terrestrial species including the avocet (*Recurvirostra avosetta*), spoonbill (*Platalea leucorodia*) and red squirrel (*Sciurus vulgaris*) (Langston, 2003). Furthermore, adjacent to the harbour are several nature reserves; Upton Heath, Arne, and Holton Heath, which are highly regarded nationally and internationally for supporting healthy populations of rare native reptiles, birds, insects and plant life (Natural England 2010).

Anthropogenic activities in the marine environment within the harbour include heavy freight and bulk movements, tourism and leisure activities, and fishing. Many of these contribute to the presence of invasive species (Pearce, 2012). Furthermore, dredging of one shipping channel to facilitate access to the harbour takes place on a regular basis (Poole Harbour Commissioners Draft Management Plan 2011). These activities are already a constant threat to its conditions and features (Natural England 2010).

The impacts of novel structures required by any renewable energy project into marine environments are largely unknown (Polagye et al., 2011). However, in the case of the

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PTEP proposal it is possible to forecast some degree of disruption to species movements and migrations, alteration of benthic habitats, contamination from paints/lubricants, injury through collision of being struck by the energy generating technology, alteration of currents/water movement, increased noise through installation and operation of technology, and the cumulative impacts of all of these stressors (Polagye et al., 2011) in addition to the existing ones. Therefore, very careful planning would be required to avoid detrimental consequences to this site which is supporting nationally and internationally protected species and habitats (Liley and Clarke, 2003).

5. Environmental Legislation

The overarching legislation in the UK that regulates development on land and in marine environments, including the activities of renewable energy projects, is the spatial planning legislation. The Town and Country Planning Act 1990 and the Marine and Coastal Access Act 2009 are the principal Acts for terrestrial and marine areas respectively. Spatial planning legislation has two main statutory levers: forward policy and programme making and the control and shaping of development proposals through the granting or refusal of planning permissions (Crawford and French, 2008) or licences, in the case of marine developments. For the Poole Tidal Energy Partnership project to be able to proceed, it must acquire consent under spatial planning legislation from the appropriate authority whose determination will be guided by spatial development plans and related policy documents. (This issue will be discussed further in section 6).

Additionally, due to its recognised ecological importance, any development in Poole Harbour needs to take into consideration certain international conventions, European and UK marine and nature conservation laws, as well as water quality legislation. This results in a complex environmental legal framework that gives several layers of protection, sometimes from different points of views, to the same site. The most relevant legislation with regard to Poole Harbour will be discussed below.

5.1 Nature Conservation Legislation

At an international level the UK is a signatory to the Convention for the Protection of the marine Environment of the North-East Atlantic, 1992 (OSPAR Convention). According to Art. 1 of the Convention, Poole Harbour and the sea adjacent to it comes within the remit of Region II Greater North Sea. Therefore, under Art. 2(1)(a) UK has a duty ´to take all possible steps to prevent and eliminate pollution and shall take the necessary measures to protect the maritime area against the adverse effects of human activities so as to safeguard human health and to conserve marine ecosystems and, when practicable, restore marine areas which have been adversely affected`. To this end the UK is required to adopt measures to tackle pollution and prevent degradation of this marine and costal environment. An expression of the application of these measures at local level is seen in the Poole Harbour Aquatic Management Plan created by the Poole Harbour Steering Group (Poole Harbour Aquatic Management Plan, 2011).

The UK also ratified the Convention on Wetlands of International Importance, 1971 (Ramsar Convention) in 1976. This convention imposes a general duty to promote the conservation of wetlands and waterfowl. ‘Wetlands’ are defined as ‘areas of marsh, with water that is static or flowing, fresh, brackish or salt, including areas of marine water

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whose depth does not exceed 6m'. Due to their ecological importance, parts of Poole Harbour were designated a Ramsar wetland site in 1999 (JNCC 2008).

In England all terrestrial areas included within listed Ramsar sites are currently Sites of Special Scientific Interest (SSSI).They are legally protected under the Wildlife and Countryside Act 1981 as amended. Poole Harbour was first designated as a SSSI in 1964 under the National Parks and Access to the Countryside Act 1949 12, 13 & 14 GEO. 6. CH. 97 (English Nature.1990) to protect its intertidal and coastal habitats. It is protected under the provisions of Part II of the Wildlife and countryside Act 1981 SI 1982 No. 1217 (C 39) as substituted by Schedule 9 of the Countryside and Rights of Way Act 2000. 2000 c. 37 (CRoWA 2000). As a result all public bodies are required to take reasonable and consistent steps with the proper exercise of their functions, in order to protect the conservation features of the SSSI. The legislation also places legal obligations on owners and occupiers of the land within the SSSI and also to any person in relation to activities that may cause damage to its special features or recklessly disturb any animal of special interest.

Section 28 of Wildlife and Countryside Act 1981 as substituted by Schedule 9 of the CRoWA 2000, further outlines the responsibilities and obligations of public and statutory bodies when carrying out activities or authorised works within a SSSI. There is a list of operations and activities likely to damage the features of special interest of Poole Harbour SSSI, which can be obtained from natural England. The owner or occupier of land within a SSSI can only allow these activities to occur on their land with the consent of Natural England.

At European level the oldest nature conservation legislation is the Council Directive 2009/147/EC on the Conservation of wild birds (EU Birds Directive). Member States designate Special Protection Areas (SPA) to conserve the birds listed in Annex 1 of the Directive, including migratory birds. The SPAs are also classed as Natura 2000 sites, which form part of a European network of protected sites.

In 1999 parts of Poole Harbour were designated SPA due to the internationally important assemblages of waterfowl and populations of certain regularly occurring resident and migratory species (Humphreys and May,2005). These species are protected by Art. 4 of the Council Directive 79/409/EEC on the Conservation of wild birds (the first Birds Directive consolidated later in the one mentioned above) and are listed in Annex II of Council Directive 92/43/EEC on the Conservation on natural habitats and of wild fauna and flora (EU Habitats Directive) and the relevant site assessment.

Under the UK Conservation of Habitats and Species Regulations 2010-SI 2010 No 490, the EU Habitats Directive forms the basis for the protection and management of the SPA (see figure 4). The part of the SPA which covers the intertidal zone of the Harbour is referred to as a European Marine Site (EMS). Any activity classed as a high risk will require additional management measures to avoid deterioration and disturbance in line with the obligations under Art 6(2) of the EU Habitats Directive (European Commission, 2000).

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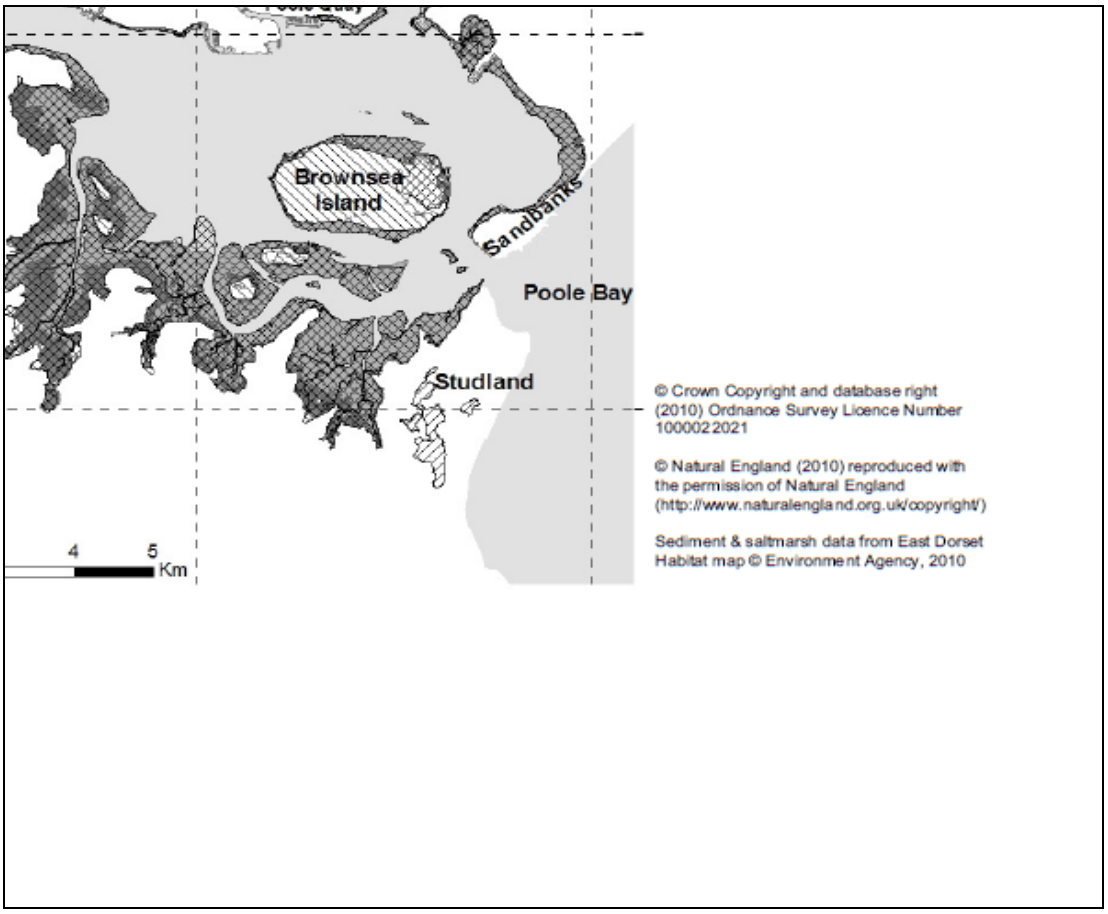

Figure 4: Map of Poole Harbour showing SSSI and SPA boundaries (source Poole Harbour Aquatic Management Plan 2011)

As discussed above, the Birds Directive and Habitats Directive impose a duty on Member States to protect SPAs and is directly applicable to Poole Harbour. However, whilst providing protection for SPAs, the latter also provides Member States with the power to permit development on protected sites in certain circumstances. Article 6(4) of the Habitats Directive states that a project may go ahead if there are no alternatives and there is an overriding public interest, including socio-economic factors. Furthermore, the guidelines to the Directive state that whilst development on a protected site, particularly one with vulnerable species, is not ideal in cases where public safety or immediate environmental protection are a necessity, plans or projects may still go ahead (Kramer, 2009).

In some proposed plans these guidelines have been subjected to significant criticism because they seem to override the nature conservation issues in favour of the socio-economic benefits. However, there are examples of opposite outcomes with regard to projects with potential detrimental impact on the environment. On the one hand, in 2003 the Dibben Bay Appeal showed that nature conservation interest were given a higher status than the economic and social interests because the proposed cargo terminal in Dibden Bay would damage the integrity of the Solent and Southampton Water Ramsar site, the SPA and other surrounding protected areas. On the other hand, in the feasibility study for a tidal energy project in the Severn Estuary, the government gave more

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importance to economic and the energy generation potential over the detrimental environmental impacts to the nature conservation sites. The final reason for the plan not being implemented was that the scheme did not appear cost effective (Ginige et al., 2011).

Another important aspect within the discussion of nature conservation law is the concept of cumulative impacts. This refers to the consequence of more than one direct or indirect impacts acting together, resulting in an outcome difficult to predict, with indirect consequences manifesting in unexpected places and after of a period time (Barrow, 2006). Different laws take this concept into consideration.

Council Directive 85/337/EEC as amended by 95/11/EC and 2003/35/EC on the assessment of the effects of certain public and private projects on the environment (EU EIA Directive) establishes the circumstances when an Environmental Impact Assessment (EIA) is required. The Habitats Directive Art.6(3) also includes a requirement to conduct another appropriate assessment if the plan or project, either individually or in combination with other plans or projects, has the potential to significantly affect the integrity of a Natura 2000 site. It is suggested that the provisions found in these Directives provide clear instructions about what must be considered, referring specifically to the requirement to use best available techniques, the need to identify all potential impacts (including cumulative ones), and the most effective mitigation measures must also be discussed (Kramer, 2009). However, despite the provision in these Directives about the considerations required to be included in the assessments (Kramer, 2009), it is apparent that there is confusion on the part of EIA practitioners regarding the definition of cumulative impacts and their specific requirements (Masden et al., 2010). Particular uncertainty arises within the UK Town and Country Planning (Environmental Impact Assessment) Regulations 1999 SI 1999 No239, where cumulative impacts are given different definitions. For example, schedule 3, section 1a, refers to them as those impacts which occur having regard, amongst other things, to the size of the development, while section 1b as those cumulating with other developments. These definitions lead one to infer that cumulative impacts are to be considered as impacts which occur across developments. However, schedule 4 part 1, which deals with information required in the environmental statements, defines these potential consequences as “a description of the likely significant effects of the development on the environment, which should cover the cumulative effects of the development”, implying that they are impacts which accumulate within the life of the project(Cooper and Sheate, 2002). Such confusion as to what needs to be considered as a cumulative impact of a development could significantly affect an EIA undertaken on Poole Harbour. Depending on the interpretation of the practitioner, could result in potential impacts going unnoticed.

Another essential concept in nature conservation law is compensatory measures. Should it be decided that a renewable energy development in Poole Harbour should be approved under grounds of “imperative reasons of overriding public interest” (IROPI), per Art.6(4) of the Habitats Directive. It would then have to satisfy the conditions set out in the Directive’s guidance notes and compensatory measures must be implemented. This means that the UK would be required to provide compensatory habitat to protect the integrity of the Natura 2000 network (Ginige et al., 2010). However, the effectiveness of creating compensatory habitats in Poole Harbour can be questioned on the grounds that alternative habitats may not be sufficient to maintain species survival. Poole Harbour was designated

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because it supports species that are rare or unique in themselves. In order to comply with the Habitats Directive, compensation must be of equal or higher quality than the habitat it is replacing (MMO, 2011). Obviously, this is no easy feat and many studies have been undertaken to understand the implications of habitat compensation. The best example of habitat mitigation in the UK was the creation of intertidal mud flats in Teesmouth (Evans 1998, cited by Atkinson, 2003) at Seal Sands through managed retreat. Here, it was found that, for the most part colonies could be re-established at new sites but there was a time lag of around three years (Atkinson 2003). This is relevant to Poole Harbour's distinct environment which provides important habitats for vulnerable birdlife. Whilst there have been studies where habitat compensation in the United States has proved successful, the same rules are not as easily applicable in Poole Harbour, where intertidal habitats are far more diverse in terms of sediment sizes and tidal ranges (Atkinson et al., 2001). Therefore, it would make a difficult enterprise to secure compensatory habitats of an equal or better standard as required under the Directive (Humphreys and May 2005).

This leads the case for creating replacement habitat prior to starting development of the old site (Atkinson et al., 2001), thus embracing the precautionary principle and ensuring that there will be successful populations of the misplaced species. It is stated in the guidelines to the Habitats Directive that "a site should not be irreversibly affected by a project before the compensation is indeed in place" (European Commission, 2007), allowing for exceptions if it takes a long time to establish a new replacement habitat. As previously identified, there can be a time lag of up to three years to fully establish a working ecosystem.

If a project received approval, presumably there would be pressure to implement it as soon as possible. Therefore, it may be difficult to ensure that compensatory habitats are able to fulfil expectations. If it was the case that a scheme was in operation prior to the creation of compensatory habitat, the Member State would be responsible to provide "extra compensation" (that the compensation must be additional in relation to the Natura 2000 network to which the Member State should have contributed in conformity with the Directives) (European Commission, 2007 pg 13). Added to this, the guidelines of the Directive suggest that if all these options cannot be fulfilled and development would affect rare species, the "zero option" (withdrawal of the project) must be considered (European Commission, 2007).

Another area of UK legislation relevant to a proposed renewable energy project in Poole Harbour is the Marine & Coastal Access Act 2009 (MCAA). It contains important requirements designed to promote and maintain biodiversity in British waters, combining the protection of the marine environment with human health, prevention of interference with legitimate uses of the sea, (section 69) and a strong emphasis on supporting renewable energy (s12) and marine economic zones (s116).

Besides all the above, it must be mentioned that much of the Harbour also lies within the Dorset Area of Outstanding Natural Beauty (AONB), which was designated in 1959 under the National Parks and Access to the Countryside Act 1949 to conserve and enhance the natural beauty of the site (Dorset Area of Outstanding Natural Beauty 2012). In addition, Poole Harbour is a site of archaeological heritage interest that was recognised in 2003, when it was identified as a Wetland of National Importance by English Heritage

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in accordance with the National Heritage Act 2002 (Poole Harbour Aquatic Management Plan 2011).

5.2 Water pollution and quality

In the UK the Environment Agency (EA) is the statutory body responsible for managing the water resources, their quality and pollution control by virtue of s.2 of the Environtment Act 1995 (EA 1995). Water pollution and water quality is regulated by the Water Resources Act 1991 (WRA) as amended by the Environment Act 1995, the Water Industry Act 1991 and the Water Industry Act 1999; together they provide the main regulatory controls in England and Wales.

The Environment Agency is charged with preventing deterioration of water quality and seeking its improvement; it has a duty to promote the conservation and enhancement of the water environment (inland and coastal waters). As well as pollution control, the Agency's responsibilities include water resource management, planning and conservation, flood defence, forecasting and warning, abstraction licences, fisheries and in some areas navigation. It also has certain duties in relation to promoting conservation; amenity and recreational facilities. Besides the EA's regulatory functions at national level, its duties also embrace the UK's obligation under the Council Directive 2000/60/EC establishing a framework for Community action in the field of water policy (EU Water Framework Directive or WFD).

The WFD set, for the first time, legal standards for monitoring and reporting the health of water bodies throughout Europe (Bell and McGillivray, 2008). The ultimate goal of the legislation is that all European water bodies assessed should meet 'good ecological and chemical status' by 2015, or must have management actively working to achieve this per Art.4.1 WFD. The Directive, and the resulting domestic law (The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003-S. I. 2003 No. 3242), applies to all terrestrial and groundwater including transitional (estuarine) and coastal waters (up to 1 nautical mile from the coast). WFD assessments are applicable to the waters in both estuaries and harbours, meaning that new developments should be able to demonstrate, prior to consent, that no detrimental impacts to the water quality could be reasonably foreseen by the proposed activity (MMO, 2012).

At a national level water management obligation under WFD is undertaken through River Basin Management Plans, which allows splitting into small catchments areas. (Article 4 WFD) The WFD takes a significant step towards integration of water protection and looks beyond immediate human interest in the protection of water considering living things dependant on water autonomously of human interest(Scott,2009). Environmental Protection:European law and Governance. Oxford Universty Press, Oxford) Standardised methodologies and assessment tools are available to ensure consistency in monitoring (Bell and McGillivray, 2008). However, with the division of larger water bodies into catchments, there is much potential for conflicts between catchment objectives and land use and water quality (Moss, 2004).

The varied management objectives of the rivers discharging into Poole Harbour (Poole Harbour Aquatic Management Plan 2011) may ultimately lead to alterations in the anthropogenic inputs which reach the harbour, thus impacting on primary production

(Scanlan et al., 2007). As a heavily modified water body, Poole Harbour should be seeking to achieve 'good ecological potential', ultimately meaning no further declines in water quality (Uriarte and Borja 2009). Specific considerations for the Poole Harbour PTEP proposal, under the WFD, should include avoidance of any activity that would permanently or periodically increase the rates of erosion, sedimentation or turbidity (Poole Harbour Aquatic Management Plan 2011). Furthermore, it must be sensitive to the protection and promotion of salt marsh areas -as the decline of these has been linked to increased heavy metal presence, e.g. cadmium, in the harbour waters- (Hübner et al., 2010). Finally, a full assessment of the likely impacts to both the biotic and abiotic components of this environment should be undertaken (MMO 2012).

The requirements for the safe installation of a closed or open loop water source heat pump system (WSHC) vary according to the different technology and risk involved. These requirements are given by the EA in *Environmental good practice guide for ground source heating and cooling,* (Environment Agency, 2011).

The closed loop heat pump systems do not currently necessitate any form of permision from the EA if located on a privately owned piece of land. But if the closed loop scheme was to be put into, or adjacent to, a watercourse it may require a flood defense consent. Whilst the majority of close loops schemes are installed and operated with no harmful effect on the environment, owners and installers should bare in mind that they are liable for any adverse effects that the scheme may cause (Environment Agency, 2011). The potential types of risk of a closed WSHC system are discharge of a polluting substance (e.g. escape of circulating fluid) and changes of temperature in the water. In the first scenario, if the scheme leads to discharge of a polluting substance to controlled waters (including ground water), the drilling contractor, the installer, the owner or operator may be liable for prosecution under Environmental Permitting (England and Wales) Regulations 2010 (EPR 2010) regulations 38(1) and 12(1). In the second scenario, if the discharge or removal of heat by the system interferes with the environment features, actions might be brought against the operator of the scheme under the UK Law of Nuisance and the EU Environmental Liability Directive.

The open loop WSHC system involves abstraction of water for heating and cooling purposes and will require an abstraction licence from the EA if the quantity abstracted is more than $20m^3/d$ in any 24 hour period ((Environment Agency, June 2010. *Managing Water Abstraction*. Environment Agency. Bristol). The water that emerges from the heat exchanger will most likely have changed its temperature. It will usually be warmer (in a cooling scheme) or colder (in a heating scheme) than the original water. This thermally changed water will be discharged into a surface water body (as defined in s.104 of the WRA 1991), in our case Poole Harbour, a natural water body. In order to obtain the required EA discharge consent permit, via the Environmental Permiting Regulations 2010, the resulting water must not contain polluting chemicals, the temperature change must be less than 8ºC, the outlet temperature must not exceed 25ºC and the discharge must be to the same water body from which the water was abstracted. Furthermore, the discharge ‘must not be made into fresh water within 500 metres upstream from a designated shellfish water, European site, Ramsar site, SSSI or any body of water identified as containing a protected species or within 100m of a wild life site’ (pg. 24).

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For a tidal water site the distance of 500m for the discharge to take place means 'in any direction' to the nearest boundary of any of the sites mentioned above (pursuant of Chapter 4 of the EPR 2010 see Environment Agency, 2010).

5.3 Environmental Liability Directive

The EU's Directive 2004/35/CE of the European Parliament and of the Council on environmental liability with regard to the prevention and remedying of environmental damage (Consolidated 01/05/2006) (Environmental Liability Directive or ELD) was transposed into UK legislation belatedly through the Environmental Damage (Prevention and Remediation) Regulations 2009 (SI 2009/153, as amended by SI 2009/3275) (EDR 2009).

A key purpose of the regulation is to make the operator of an activity solely responsible for putting right any environmental damage, or threat of environmental damage (and the costs of so doing), caused by his activities – i.e. application of the polluter pays principle. The operator will also be liable for any remedial costs incurred by the enforcing authority unless he can demonstrate that the environmental damage (or threat of environmental damage) was caused by a third party (Bergkamp, 2002)

Environmental damage according to the EDR 2009 is damage caused by an activity listed in schedule 2 to: protected species or natural habitats listed in the EU Birds Directive and the EU Habitats Directive– mainly those on Natura 2000 sites – and also to those on SSSI notified under the Wildlife and Countryside Act 1981.

EDR 2009 schedule 1 details the threshold of damage for: species and habitats on and off SSSIs; surface water or ground water, including any adverse effect on the environment of surface or groundwaters resulting in the deterioration of status as defined in the WFD, whether ecological, chemical or quantitative; land where it relates to contamination which brings about a significant risk to human health or contamination through the introduction of organisms or micro-organisms. The activities causing damage are listed in schedule 2 and include: permitted installations; waste management operations; mining waste; discharges requiring authorisation; water abstraction and impoundment; manufacture, use, storage etc of dangerous substances; plant protection products and biocidal products; transport of dangerous goods; contained or deliberate release of genetically modified organisms; and transboundary shipment of waste.

In the case of environmental damage to protected species, natural habitats or SSSIs, the EDR 2009 also covers damage caused by any other activity if the operator either intended to cause the damage or was negligent as to whether damage would be caused (part 1 section 5).

It excludes from its scope any environmental damage that took place before the EDR 2009 came into force (part 1 section 8 EDR 2009); environmental damage caused by oil pollution, in which liability or compensation falls within the scope of relevant international conventions such as the 1992 Protocol to the Convention on Civil Liability for Oil Pollution Damage; damage caused by radioactivity from an activity covered by the Treaty establishing the European Atomic Energy Community; environmental damage as a result of an 'act of terrorism', 'natural disasters' such as hurricanes or exceptional

flooding (but regular seasonal flooding is not excluded) , and damage caused by commercial sea fishing carried out in compliance with the Common Fisheries Policy.

The EDR 2009 also exempts damage to water caused by new modifications to the physical characteristics of a surface water body, alteration to the level of a body of groundwater, and deterioration from high to good status of a body of surface water resulting from new sustainable human development activities.

Under the EDR 2009 s20 (1) if relevant harm has occurred, the operator responsible must take remedial measures. If the primary remediation does not fully restore the damaged site, 'complementary' remediation must be undertaken, on the site or elsewhere, to compensate for that fact (EDR 2009 schedule 4, Part1, section 5) . 'Compensatory' remediation will also be required to make up for the interim losses during the period until the primary and complementary measures take effect. Guidance is given on the choice of measures and what is appropriate for complementary or compensatory remediation where direct equivalence is not possible. For conservation sites, the effect is that if a site is destroyed or cannot be wholly restored, then alternative or supplementary measures must be taken to provide the same overall conservation value, albeit not necessarily a direct equivalent to what has been lost, and before the damaged site is fully restored or a substitute provided, interim measures must be taken to make up for what is temporarily lost. Here, although the responsibility is on the operator to propose and undertake the remedial action, it is still the relevant 'competent authority' that determines what must actually be done (Reid, 2011).

To sum up, there are different levels of environmental legislation that protect Poole Harbour's biodiversity from the threat of antropogenic activities. This patchwork quilt of laws aim to conserve specifically: the wetland, intertidal and coastal habitats, resident and migratory wild birds, the natural beauty of the site, its archaeological relevance, the marine ecosystem and the water body itself autonomously of human interests. At the core of these laws is the need to promote a healthy marine ecosystem alongside minimal restrictions of human activities. This is achieved through site and species designations, regulations of the works and activities carried out in the Harbour, by placing legal obligations to those carrying activities within the site and by requiring EIA where there is risk of harm to the protected characteristics of the site. Furthermore, the law establishes a system of liability and compensation measures in the event of potential and actual damage to the environment.

These laws are indicative of the international and national recognition given to Poole Harbour's ecological features. They acknowledge the impact that human activities have on the natural environment and the need to promote sustainable interaction. Nevertheless, the discussion above demonstrates that, in certain provisions, the law seems to give adequate protection to the environment, whilst in others is restricting its effectiveness . It is suggested that this incongruency stems from the attempt to engage with what seem to be conflicting agendas: the safeguard of the environment on the one hand and antropogenic activities on the other, including the promotion of renewable energy. Although the latter results from the attempt to mitigate climate change, it carries the burden of this tension.

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6. Spatial Planning

It is important to recognise that a key aspect to the implementation of any development project is the understanding of the legal framework, plans and policies for the control or management of development. (Moore, V. 2010) The merits or otherwise of a proposal will be examined, assessed, having regard to policies and plans, and determined by the granting or refusal of consent. In the context of coastal or marine works, the two main types of development consent required are:

1. planning permission for infrastructure to the boundary jurisdiction of the Local Planning Authority (generally above the Mean Low Water Mark (MLWM)) under the Town and Country Planning Act 1990 and
2. A Marine Licence for works below Mean High Water Springs (MHWS) under the Marine and Coastal Access Act 2009.

The two systems work independently of each other and are administered by Local Planning Authorities and the Marine Management Organisation (MMO) respectively. There is, however, a reciprocal system of consultation on development proposals. Applications for development will be determined in accordance with the Local Plan of the Local Planning Authority in the case of land-based development and in accordance with the relevant Marine Plan in the case of in and off-shore development. In locations where Marine Plans have yet to be produced, in the interim, direction on licensing decisions will be given by the (MPS) Marine Policy Statement.

Focusing on the in-shore development of the Poole Harbour project, the construction, alteration or improvement of any works either in or over the sea or on or under the sea bed (including off-shore generating stations with a capacity between 1 and 100 megawatts) requires a marine licence. Generating stations of a greater capacity are deemed to be national significant infrastructure projects and are subject to a different system of consent under the Planning Act 2008.

6.1 Stakeholder Engagement

Environmental management (and decision making) is as much about managing human activities as managing land and water, therefore requiring the effective engagement of all stakeholders (including government agencies, NGOs, the business community and the general public) in the process of information gathering and policy making. Engagement and participation engenders a sense of ownership of information and policymaking resulting in a common understanding of issues and a negotiated learning process. In the United Kingdom, as in many countries, part of the political agenda for improving governance at national and local level is the promotion of community capacity building across a range of policy areas including spatial planning. Participation is an integral part of Strategic Environmental Assessment (SEA) Directive 2001/42/EC and EIA Directive and in many countries, including the United Kingdom, participation is a mandatory requirement for all planning decisions.(Hodder et al., 2009).

Both the established terrestrial planning system and the emerging marine planning system seek to engage the local community and stakeholders at each stage of the planning process - from information gathering, plan and policy making to implementation. Both systems incorporate a Statement of Community Involvement or Statement of Public Participation which set out how local communities and stakeholders will be consulted,

how they can be involved in the formulation, alteration and review of policies and the part they can play in consideration of applications for development. The development of The Marine Policy Statement, for example, was shaped through the involvement of stakeholders through regional and national workshops and consultations on firstly, a discussion paper, followed by a draft policy statement. The latter generated 126 responses across a range of sectors and comments were invited and received on the supporting documents (the Appraisal of Sustainability (including a Strategic Environmental Assessment); Habitats Regulations Assessment, Impact Assessment and Equalities Impact Assessment screening) as well as on the draft policy statement. A summary document (HM Government. March 2011.*UK Marine Policy Statement*) has been published which details the main changes made to the final Marine Policy Statement as a result of public consultation, parliamentary scrutiny, and the policy finalisation process. It also details key comments made that have not been implemented in the final text and reasons for this. One pertinent point of interest was the discussion on how the Marine Policy Statement will prioritise between differing policies and activities and the suggestion that there were implicit priorities in the draft policy statement which inferred that planning should allow or encourage certain activities over others. Comments by respondents to the consultation express a range of views including "too much focus on environmental aspects and not enough focus on socio-economic aspects; the environmental pillar not being given sufficient prominence" (HM Government. November 2010. An Initial Summary of Responses to the UK Marine Policy Statement). There were also requests for more clarity on how conflicts would be managed in the marine planning system.

6.2 Integration of Policy Objectives

Just as land use planning seeks to reconcile competing claims for the use of land, the marine planning system, as expressed in the Marine Policy Statement (2011), seeks to "contribute to the achievement and integration of sectoral/ activity specific policy objectives within a framework of economic, social and environmental considerations". With reference to Marine Plans, which will provide a locally relevant expression of policy, implementation and delivery, a key principle will be to promote compatibility and reduce conflict. Responding to the consultation respondents' comments on implicit policy priorities (HM Government. March 2011.*UK Marine Policy Statement*), the government makes clear that the Marine Policy Statement does not prioritise one activity over another and relative priorities will be most appropriately determined through the marine planning process, taking into account a wide range of factors alongside UK policy objectives, including the specific characteristics of individual Marine Plan areas. On the question of clarity on the management of conflict, the government's response is that Marine Plans should identify areas of constraint and opportunity for a range of activities and that engaging local communities and stakeholders in all stages of the planning process engenders support for plan-led policies, can identify opportunities for compatible uses and minimises potential conflicts. Further, it emphasises the role of evidence in conflict resolution.

7. Conclusion

The above discussion acknowledges that in principle, community renewable energy projects, such as the Poole Tidal Energy Partnership initiative, are an innovative and successful way to supply energy to homes and businesses on a small scale with a range of

associated benefits for local people and ecosystems (Rogers et al., 2012). These type of projects require detailed consideration of financial and technological viability, as well as their potential impacts on the environment. Environmental impacts assume even greater importance when the environment into which the development is introduced is valued for its habitats, species and amenity, particularly, as is the case with significant areas of Poole Harbour, it is subject to statutory designations and legal protection.

Crucial, therefore, to consideration of the Poole Harbour case study, given the government's twin objectives of mitigating climate change through the promotion of renewable energy and sustaining and enhancing biodiversity, is the capability of decision makers to integrate or reconcile these two policy objectives. The question is not whether one policy objective should take precedence over another, but whether spatial planners can work with engineers, ecologists, economists, environmental lawyers, the public and other stakeholders to gather robust evidence to realise renewable energy opportunities with minimal impact to species, habitats or ecosystems.

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LEGAL CHALLENGES FOR GREEN BUILDING RATING SYSTEM

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ABSTRACT

Sustainable development has gained great interest in the last decade in the U.S.A. and all over the world. The U. S. Green Building Council (USGBC) has prompted sustainable development in built environment. As sustainable building practices are become more popular and acceptable, new legal challenges have accordingly involved. Legal disputes are nothing new to the construction industry, but a green building rating system such as Leadership in Energy and Environmental Design (LEED) has created a new wave of legal challenges. To understand the potential risks involved with this new wave of legal challenges, current and past lawsuits have been examined. The three main areas are identified and classified through a qualitative approach. They include lawsuits against USGBC, lawsuits due to falling short of getting LEED certified or not getting the certificate at all, and legal challenges due to defective design and materials. The findings will inform different parties involved in the green building practices of potential risks and liabilities to avoid future lawsuits.

Keywords: Lawsuits; Leadership in Energy & Environmental Design (LEED); U. S. Green Building Council (USGBC); LEED Certificate; Green Building.

INTRODUCTION

The U. S. Green Building Council (USGBC) encourages owners, architects, engineers, and ultimately the consumers to go "green." USGBC has prompted sustainable development in built environment to encourage stakeholders "to meet the need of present without compromising the future generation's needs" (Our Common Future 1987). USGBC later established Leadership in Energy and Environmental Design, known as LEED, to certify buildings if they meet the minimum performance requirement and then earn the minimum credits for each of four certification levels. The owners choose to pursue LEED for a variety of reasons such as higher rents and assets values and potentially lucrative financial incentives offered by state and local governments (Taylor and Olsen 2012). Owners have started implementing the use of LEED in their planning as a need for projects. Under LEED, a third-party verifies that

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a building was designed to improve energy saving, water efficiency and indoor environmental quality, among other environmentally friendly attributes.

While rewards can be gained from the move toward sustainable construction, there are also new risks and unnecessary and costly litigation when the projects fail to perform as promised. A review of the common law of contract damages would be informative as to potential liabilities facing the project participants who are responsible for the success or failure of the project's goals. Moreover sustainability has gain interest in last ten years thus new risks in addition to common risks involved in construction has emerged that could mark a new wave of construction lawsuits. With the growing demand emphasized on sustainability, legal concerns must be addressed. Little attempt has been made to determine the cause of legal disputes on "green" projects. By conducting a thorough review of legal cases on green building rating system, this paper examines the variables from a legal stand point to shed light on legal issues and liability of the various parties involved in a LEED projects to avoid future lawsuits.

Green building is expected to more than double in the next five years (McGraw-Hill Construction's Green Outlook 2011). More industries are getting involved with green building as they build, renovate or expand their facilities to take advantage of improvements in sustainable materials and promises of energy efficiency, cleaner air and tax credits (Hughes 2010). All 50 states in the nation and 91 countries currently have LEED projects underway. According to USGBC an average of $464 million worth of construction register with LEED on every business day. However, major barriers to green buildings in the United States include financial disincentives, insufficient research, and lack of awareness (Kibert 2008). With the new trend of green buildings new problems come. A number of variables influencing legal disputes are identified through a review related articles and court documents on LEED. The next section reviews and groups legal challenges into three main categories. These include lawsuits against USGBC, falling short of getting the desired level of LEED certificate or not getting the LEED at all, and disputes caused by defective sustainable materials and techniques.

LAWSUITS AGAINST USGBC

A well recognized lawsuit against USGBC is the Henry Gifford case. Energy-efficiency consultant Henry Gifford launched a $100 million class action lawsuit against the USGBC, going after them for "Sherman Act Monopolization through fraud, unfair competition, deceptive trade practices, false advertising, wire fraud and unjust enrichment." Lawsuit was later dismissed (Gifford et al. vs. USGBC, Case No. 1:10-CV-07747). Along six allegations two are the most interesting. The Complaint alleges that the LEED rating system is not based on objective scientific criteria or actual measurements; rather it is based on a supportable point system that awards points in a fundamentally weak manner. The Complaint further alleges that USGBC "commissioned a study by the New Buildings Institute (NBI) which: used skewed samples in its data collection; used biased survey takers; compared a set of new LEED buildings to a set of both old and new non-LEED buildings" (Case No. 1:10-CV-07747). The Complaint alleges that these "skewed samples and data are fraudulently misrepresentative and are being used by USGBC to market its system and products through press releases and its website" (Case No. 1:10-CV-07747).

A further study was conducted for the U.S. House of Representatives. An investigation on "the science behind the green building rating system" was launched to determine the credibility of USGBC. The study summarizes the data and identifies key flaws in the NBI's methodology. It indicates that in 2007 USGBC commissioned the New Building Institute (NBI) to gather energy consumption for LEED certified buildings to determine if these building consume less energy. The NBI concluded that LEED certified building on average perform 25-30% better than national average (Turner and Frankel, 2008). With the publication of NBI findings, it immediately came under criticism. A New York mechanical engineer criticized the study on two counts (Case No. 1:10-CV-07747). The first was that the LEED data were volunteered by building owners who were willing to share their data, and therefore it was not representing all LEED certified buildings. Second, NBI's comparison was based on the median energy intensity of LEED buildings with the mean for all commercial buildings. It was stated that the mean energy intensity for the LEED buildings in the NBI study was actually 29% higher than the corresponding mean for all U.S. commercial buildings.

In 2008 the APS Energy Efficiency Study Committee confirmed these allegations by writing, "Whatever their efficiency, these 121 LEED buildings consume more total energy per square foot (either site or primary) than the average for the entire commercial building stock" (Richter et al. 2008). It was stated the "buildings included in the NBI study are probably more efficient than the 80% of the LEED-certified buildings for which NBI was not able to collect energy data" (Scofield 2012). The study summarizes that "analysis of the LEED building energy consumption data gathered by NBI shows that LEED-certified commercial buildings use about the same amount of primary energy as their conventional counterparts. Furthermore, LEED certification has not been useful in reducing building energy consumption and emissions associated with building operation, thus there appears to be no scientific evidence to back USGBC's claims (Scofield 2012).

USGBC'S LEED CERTIFICATION

One of the areas where most lawsuits could potentially arise is not achieving the certification that was anticipated or not getting the certificate at all. This area has the biggest potential for future lawsuit. Regarding this matter several cases had evolved considering the fact that LEED has gain recognition only in the past few years. Looking at reported cases to establish the legal pattern can help to identify some of the issues that have evolved around the failure in achieving LEED certificate or not getting the desired level of certificate. In the research of the current lawsuits some initial pleadings and factual background were uncovered on a state trial court case from two lawsuits that provides some insight. First is Shaw Development vs. Southern Builders. The lawsuit in question is about the construction of a $7.5 million condominium complex in coastal Maryland. From what can be gathered, the initial pleadings included the specifications of a stated goal for the project to achieve a LEED silver certification to be issued by USGBC (Shaw Development vs. Southern Builders, Case No. 19-C-07-011495). The owner was interested in the LEED because of state tax incentives related to new buildings achieving LEED certification. In this case the state of Maryland offers tax credits up to 8% of the total project costs for projects which achieve a LEED certification. These tax credits were not specifically mentioned or claimed in the contract but the LEED certification was clearly stated in the specifications as a sustainability objective. As it turns out the performance of the

project team delayed the receipt of LEED certification which subsequently disqualified the owner from receiving the tax credits, the owner pursued a cause of action against the builder based partially on these lost tax credits.

Another interesting case is Bain vs. Vortex Architect. The project involved the renovation of a three story former farmhouse dated 1883 to achieve a LEED Certificate (Bain vs. Vertex Architect, Case no. 2010L012695). The plaintiff alleges that Vortex Architect breached the architectural contract, stating that "Vertex committed numerous breaches of architectural contract in that it provided architectural services for the project in a manner consistent with locally standards for professional skill and care. Specifically, Vertex failed in its duties as architect for the project on numerous counts including failure to diligently pursue and obtain for the project certification from the USGBC LEED for Home Program" (Case no. 2010L012695). An interesting study by Harvard School of Law indicates that liabilities associated with building green may arise from several legal theories, including failure to deliver a promised level of certification (Bowers and Cohen 2009). In addition to extra cost for building green, parties involved could face potential risks by failure in achieving LEED certificate similar to the two latter cases. To this extend buyer has high expectation for his "sustainable" building, and when the expectations are not met, the owner is held liable.

An owner could also be at risk by failing to receive tax credit for the project. This could substantially affect the outcome of the anticipated project budget as it happed on the Shaw Development project. If the owner is seeking a specific level of certification in order to qualify for tax credit, the owner should seek to make its expectations of achieving the certification and achieving the tax credit clear in the contract document. Parties may also be subject to fraud claims as a result of false or misleading statements made in agreements or other communications regarding the performance or attributes of green buildings. Failure to deliver a promised level of certification, and failure to meet energy efficiency standards can create problems for the owners, design professionals, and contractors involved. Owners could face claims of misrepresenting its building and be accused of false advertising and fraud. As the design professionals' perspective, they could be held liable for not meeting the promised certificate due to defective design. For the contactors, they could be held liable for not delivering features as promised by contract. Moreover the contractors can get in trouble for defective materials and construction techniques.

DEFECTIVE DESIGN AND MATERIALS

Another area that could potentially have high risk for future lawsuits is from defective design and new sustainable materials. An interesting case covering defective design was developed in Chesapeake Bay in Maryland which was the first project that received a LEED platinum from USGBC. The lawsuit in question involved a 32,000-square-foot office building with plaintiff Chesapeake Bay Foundation, Inc, and the defendant being Weyerhaeuser Company (The Chesapeake Foundation INC. vs. Weyerhaeuser Company, Case 8:11-CV-00047-AW). According to suit filed by Foundation, "contractor provided defective, inferior building material" for the Foundation project. Few years after the completion of the project an inspection revealed that deterioration and rotting had occurred on structural members which led to lawsuit against the material's manufacturer. According to the study done by Harvard School of Law construction defects could result from improper installation

that may result from the failure to understand the system (Bowers and Cohen 2009). When an individual is not familiar with a new product or system he or she may install the product improperly, resulting in short life span or failure of the material or failure of the entire system.

Furthermore many manufacturers and suppliers promote their equipment and products as environmentally friendly while they haven't been actually tested and proven. Contractors must be aware of potential unsafe environmentally friendly materials. Also owners and contractors should be aware of the liability of the third party risk involved. The latter lawsuit was an example of potential risks involved with new sustainable materials.

DISCUSSIONS

Examining the reported cases to establish the legal pattern can help to identify some of the issues regarding future litigation surrounding LEED. Unfortunately reported cases on this aspect of green building law are very few to non-existent due to its short existence and it has only gained interest in the last decade. Due to the nature of the research, a qualitative approach has been used to identify where future litigations could potentially arise. Information provided in the literature review is categorized into three categories, Lawsuits against USGBC, shortfall of getting LEED or desired LEED, defective design and materials, and finally other type of claims. Then each category of the three main categorizes has been divided into sub-categories comparing type of litigation, year in which lawsuit was filed, type of claim, total amount of dispute, area of LEED (if applicable), and ruling of the court. The broad types of claim shows the great potential that LEED has for different claims, but some claims have been repeated under each category (ex. Breach of Contract) which indicates the greater potential for future litigations in that specific area.

Building performance is based on design, construction and operation, but LEED is achieved before the building is occupied. The litigation has highlighted the difficulties in ensuring the buildings performance as they are meant to perform and also the problems in developing benchmarks for measurements. To these ends, LEED certification processes are evolving. Under LEED's Minimum Performance Requirements (MPRs), which apply to projects registered under LEED 2009 (except for LEED ND), buildings are now required to commit to periodically submitting energy- and water-use data for at least five years. The relative emphasis in the rating system on reduction of energy use and greenhouse gas emissions associated with buildings systems has also been increased (LEED 2009). USGBC has instituted the Building Performance Partnership, in which participating buildings receive annual performance information, comparing predicted or actual performance at the time of certification with the building's current performance, in order to address the disparity between how buildings are designed to perform and how they actually do perform (USGBC 2012). LEED-NC uses predicted energy cost ($/yr) as the primary energy metric following the lead of ASHRAE Standard 90.1. LEED-EB uses the EPA EnergyStar Buildings program which is based on the measured (not modelled) Energy Use Intensity or EUI (kBTU/sf-yr). EnergyStar normalizes buildings against similar facilities in the US Department of Energy's CBECS database.

Table 1 tabulates the lawsuits related to the three areas. Although the different types of claim have been brought up against USGBC, two are most relevant for the purpose of this study. This lawsuit has a claim under Lanham act that classifies it as a class action lawsuit, has a substantial disputed dollar amount. To avoid future lawsuits similar to the latter case, USGBC has to come up with a proven technique to satisfy all parties involved. Furthermore with the investigation of the House of Representatives more action should be taken from USGBC's part to defend its rating system. Examination of the lawsuits due to failure in achieving the certificate revealed that the dollar amount could vary substantially and no project, big or small, is safe from disputes.

Table 1. Summary of Lawsuits

	Year	Claim	Total dispute amount ($)	LEED	Court ruling
Against USGBC	2000	▪ Violations under the Sherman Anti-Trust Act ▪ Unfair competition under the Lanham Act ▪ Deceptive trade practices under the N. Y. General Business Law ▪ Racketeer Influenced Corrupt Organization Act wire fraud pursuant ▪ False advertising ▪ Unjust enrichment	100 Million	NA	Dismissed on two count, ongoing for 4 counts
Certificate	2007	▪ Negligence ▪ Breach of contract	635,000	Certificate	N/A (Arbitration)
	2010	▪ Breach of architectural contract ▪ Breach of construction contract	50,000	N/A	N/A
Material and Technique	2010	▪ Defective and inferior building material	6 Million	MR	Granted motion, on going

Most of the problems surrounding LEED could be resolved by proper contract documentation. "If the contractor intends to take responsibility for obtaining LEED certification, then it should do so with full knowledge of the contractual risks it is assuming" says Spencer (2010). The contractor may agree to build the project in accordance with LEED principles and help the owner in obtaining credits, but not guarantee LEED certification. There are a couple of industry contract forms that are appropriate in certain circumstances. However industry contracts have generally failed to thoroughly address the unique issues arising in LEED construction projects. Both owners and contractors standard contracts do not address green building risk and liability.

Note that disputed dollar amount could be substantial when it comes to replacing or repairing inferior materials. An interesting finding is that most of the lawsuits had

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occurred around 2009 and 2010. This might be the peak of sustainable construction or could be because of the recession and shortage of capital. Furthermore by comparison of the litigations, some claims have been repeated in different area of the three main areas, as shown in Figure 1. The graph indicates that most problems arise from breach of contract. A LEED project contract must address responsibility for LEED certification and liability for green materials. The contract must address what damages the parties can or cannot recover related to the LEED process and certification. Contractors should clearly state that energy savings and LEED certification are anticipated, but not guaranteed.

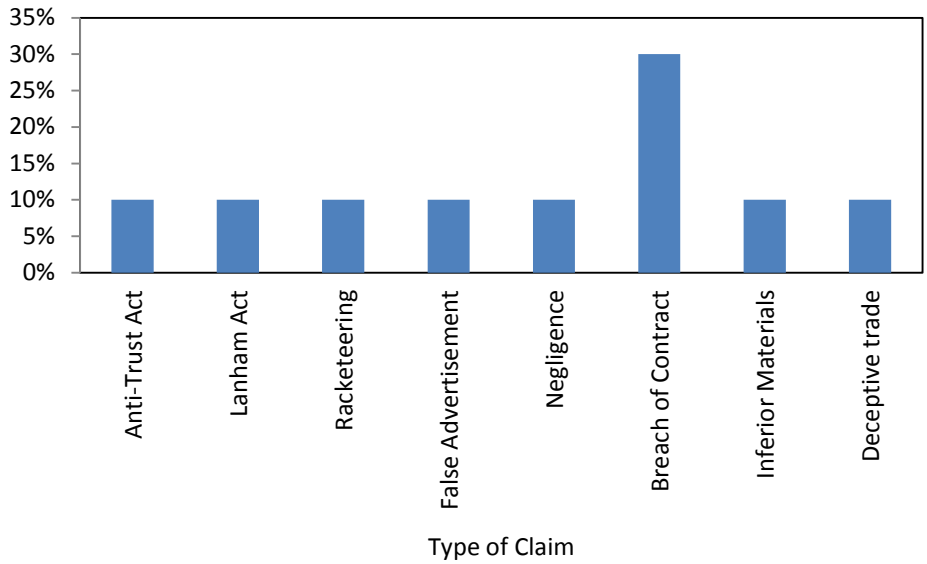

Figure 1: Comparison of total number of claims

CONCLUSIONS

It is clear that sustainable construction isn't going away anytime soon. The new wave of lawsuits in the construction industry must be minimized by thorough investigation into vulnerable areas of LEED. This paper has examined the areas in which past lawsuits had occurred in light of foreseen the near future of legal issues surrounding LEED. A number of variables influencing legal disputes were identified followed by a thorough review of the variables based on related articles and court documents. Study of previous literatures suggests that legal challenges are grouped under three main categories. These include lawsuits against USGBC, falling short of getting the desired level of LEED certificate of not getting the LEED at all, and disputes caused by defective sustainable materials and techniques. Once categorized, it was noticeable that in each area there is pattern with regards to year, type and dollar amount of each category. A further comparison of all three main categories revealed that the breach of contact plays a significant role in disputes. It was found that the size and scale of the project may not affect the risk of having a lawsuit on hand. The major factor for the dollar amount of the claim is the potential damage to the damaged party. The weaker attribute in comparison was court rulings. To address the latter issue future studies have to be conducted. It is unquestionable that sustainable construction will be an increasingly important topic in the years to come, hence as a new wave of construction lawsuits arise, trained lawyers in this area of construction are needed to tackle these waves.

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Legal steps to achieve climate adaptation in the Norwegian built environment

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Abstract:
Main trends towards year 2100 predict a worsening climate, with prospects of grave impacts to the built environment. If appropriate measures are not effectuated, the built environment will struggle to endure the impacts of aggravating climate strain. Vulnerability and adaptive capacity to climate change in the built environment is depending on the legal framework and its implementation in the construction industry. Earlier, the Norwegian planning and building legislation was indistinct in climate related matters. During the latest decade the legal focus on climate has however undergone considerable changes. The paper displays the latest, climate related amendments of the Norwegian planning and building legislation. Further, it discusses possible effects of the amendments and statutory interpretation performed by professional building process participants. Finally, a reflection of whether and how the amendments will lead to the obtaining of successful adaptation to climate aggravations in the built environment is presented. The methodological approach is based on a theoretical overview extracted from an annotated bibliography in the ongoing research project BIVUAC (Building and Infrastructure – Vulnerability and Adaptive Capacity to Climate Change), and results from a qualitative case study in the ongoing priority program Climate 2050 at SINTEF Building and Infrastructure (SINTEF B&I).

Keywords:
Building process, built environment, climate adaptation, climate change, legal amendments.

1 Introduction

Main trends towards year 2100 predict a worsening climate, with prospects of grave impact to the built environment. If appropriate measures are not effectuated, the built environment will struggle to endure the impacts of aggravating climate strain. Vulnerability and adaptive capacity to climate change in the built environment is depending on the legal framework and its implementation in the construction industry. Earlier, the Norwegian planning and building legislation was indistinct in climate related matters. During the latest decade the legal focus on climate has however undergone considerable changes.

The importance of adaptation to varying local climatic challenges has drawn attention in several Norwegian research projects (Lisø and Kvande, 2007; Eriksen et al., 2007). Local adaptation, both to present climate variations and to climate change, is dependent on institutional, technological and financial resources critical to the capacity to undertake actions (Næss et al., 2005; Smith et al., 2003; Yohe and Tol, 2002). How actual institutional relations and features can promote or constrain adaptation actions is however less explored (Eriksen et al., 2007; Eakin and Lemos, 2006). The implementation of legislative requirements, policies and local authority decisions through local policy instruments and other tools have been distinguished as important in promoting climate change issues (Tompkins and Adger, 2005). Sorrell (2003) argues however that the institutional organization of a sector may seem barrier-building and can impair the effectiveness of legislation in advancing climate-related issues, demonstrated through building sector examples from England. This is parallel to findings in e.g. case-studies of the Norwegian building sector and the Mexican water regulation sector (Eriksen et al., 2007; Eakin et al., 2011).

2 Objectives and methodological approach

The paper displays the latest, climate related amendments of the Norwegian planning and building legislation. Possible effects of the amendments are enlightened. Further, discussions on the interpretation of statutory requirements by local authorities and professional participants of the building process and their implementation in practice are displayed.

2.1 Objectives

Main objectives in the discussion are:

- How is climate adaptation of the built environment ensured through the Norwegian planning and building legislation?
- How are the legal provisions implemented and effectuated by the public and professional participants of the building process?
- Does the implementation of legal provisions seem to adequately support necessary actions for adapting both existing and new built environment to climate change?

2.2 Method

The methodological approach is based on a theoretical overview extracted from an annotated bibliography (not yet published) in the ongoing research project BIVUAC (Building and Infrastructure – Vulnerability and Adaptive Capacity to Climate Change), and results from a qualitative case study in the ongoing priority program Climate 2050 at SINTEF Building and Infrastructure (SINTEF B&I). The objectives are enlightened through a discussion of the empirical findings towards the theoretical background. Possible actions are presented with the conclusions. BIVUAC is a multidisciplinary joint research project of SINTEF B&I, and Vestlandsforskning, funded by the Research Council of Norway. The Climate 2050 project is an in-house Climate Change Priority Programme at SINTEF B&I.

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3 Theoretical overview - Background

Developing countries have so far been subject to the main attention with respect to climate adaptation and anticipated problems. Adaptation in developed countries with higher financial, technological and institutional capacity has been assumed to be largely unproblematic. Due to exposure to climate change and lacking adaptive capacity, developed countries may too have vulnerability issues (Morrow, 1999; O'Brien et al., 2004a). As other western societies, Norway may be less prepared for a changing climate than what has been assumed (O'Brien et al., 2006; IPCC, 2007).

3.1 Present and future climate in Norway

Norwegian climate is extremely varied. Large spatial and seasonal differences are due to vast geographical and topographical variations. A long coastline and rugged and steep topography makes the built environment particularly vulnerable to a harsh, cold and wet climate. The western and northern coast experience frequent and extreme weather events such as coastal storms, heavy precipitation, avalanches and landslides. The same areas endure the highest mean temperatures, the heaviest loads of precipitation and the strongest storms of the country (Lisø, 2006).

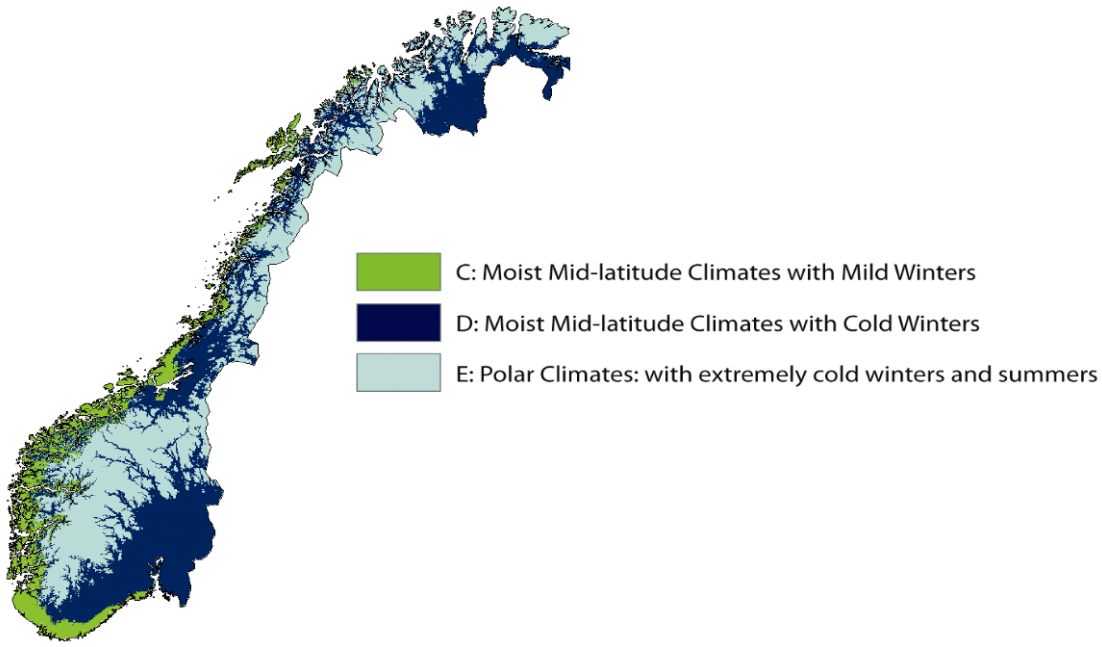

FIGURE 1. The climate of Norway based on the Köppen Climate Classification System (developed by W. P. Köppen around 1900). The map is prepared by the Norwegian Meteorological Institute, using weather data (annual and monthly averages of temperature and precipitation) from the reference 30-year period 1961–1990 (Lisø 2006).

Climate change impact in Norway will induce increased amounts of mean annual precipitation (www.met.no). Precipitation during summer, autumn and winter will increase the most. The strain will likely be most aggravated in areas that already experience the toughest conditions. Extreme weather events will occur more frequently.

Increased amounts of precipitation will lead to higher water pressure on the ground, resulting in erosion, landslides, and more frequent flood incidents. The amounts of snow during the winter season will likely diminish in large parts of the country, and more often be converted into wet precipitation.

3.2 Climate challenges and the built environment

Precipitation, wind, temperature and combinations of these cause costly damage to the built environment. Indirect climate strain, such as ground water level and -pressure, and flooding, may as well lead to severe moisture related building defects in both existing buildings and new buildings during the construction process.

Local and regional climatic diversity has historically been reflected in considerable local and regional differences in building styles (Eakin et al., 2011; Eriksen et al., 2009). Continuous development of material, production methods and industrialization, solutions, marked demands, knowledge, design, legislation, standardization, etc. have however lead to an increased uniformity, leading to the neglecting of local and regional differences in climate challenges (Lisø and Kvande, 2007; Øyen et al., 2012). The building industry is struggling with a relatively high number of moisture related building defects; often recurring faults, and a high number of climate strain induced defects. The SINTEF Building and Infrastructure Building Defects Archives display that as much as 60 % of process induced building defects origin in the early stages of the building process, prior to construction initialisation[1].

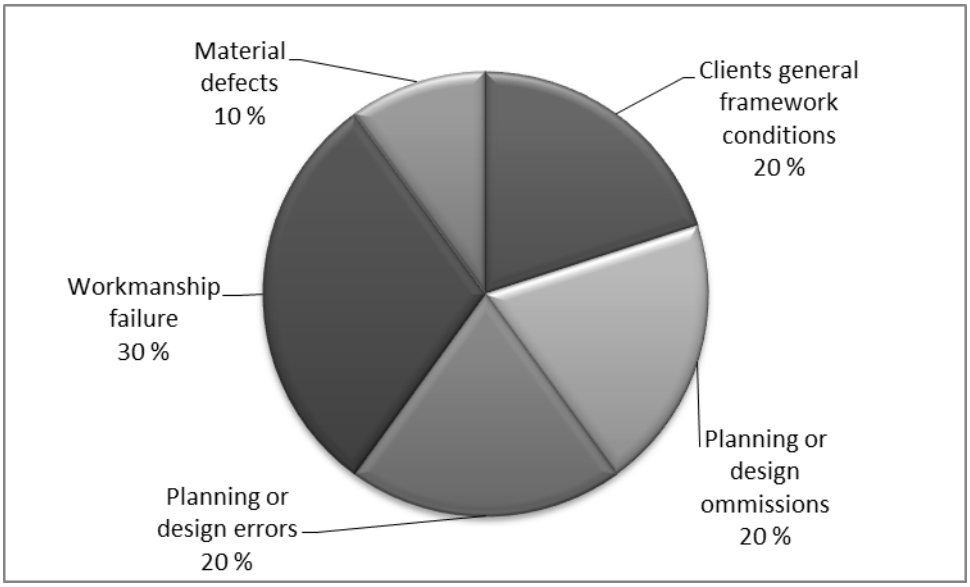

FIGURE 2. Process induced building defects distributed by source of defects. The figure displays that up to 60 % of process induced building defects origin in the early stages of the building process. The figures are drawn from the SINTEF Building and Infrastructure *Building Defects Archives* (Lisø et al., 2006).

Lacking implementation of climate aspects in tools and policy instruments may be some of several causal relations. So may issues related to local and regional diversity in

[1] Process induced building defects origin during the building process but are discovered subsequent to the client's acquisition of the building

climate challenges (Lisø and Kvande, 2007), as well as changes in public institutional organization (Eriksen et al., 2007 and 2009).

3.3 Planning and building legislation: Development and amendments

The early versions of the Norwegian building legislation did not embrace planning. Since 1845 the Norwegian building legislation has been subject to numerous revisions, also serving as a historically important tool for the social government in forming the Norwegian built environment. In 1965, Norwegian municipalities experienced a large transformation through the conversion of the planning and building legislation into a performance-based and more general level framework. This was partly caused by an increased frequency in revisions due to a heavily expanding focus on building material (Bratberg, 1995).

A simplified and decentralized decision process was implemented in 1985, also embracing land use planning. The new Norwegian Planning and Building Act of 1985[2] has hitherto undergone two major amendments, (1995/-97 and 2008/-10). Severe downscaling of local authorities' technical activities in the nineties, weakened the local planning and building authorities´ ability of guaranteeing the implementation of legal provisions, and led to an unclear distribution of responsibilities (Nørve, 2005). An extreme storm event on New Year´s Day in 1992 uncovered the strong need for increased quality demands, becoming a major driver behind the 1995/-97 legislative amendment. Refocusing on liability, control, appropriate skills and qualifications in building projects, an alteration of foci and a radical change of application processes for Norwegian municipalities was entailed (Øyen, et al., 2007). Clear distribution of responsibilities and roles, implementation of internal and independent control, and reintroduction of municipal supervision in construction projects were important efforts.

Previously, knowledge of local conditions was incorporated in building projects both by professional participants and through executive work in municipal administrations. By removing the means of ensuring incorporation of local concerns early in the building process, an important level of quality assurance incorporating local climate conditions disappeared. As a remedy, start-up meetings for planning and preliminary conferences for building applications were introduced (Berg, 2005; Nørve, 2005; Øyen et al., 2005). The aim was to inform stakeholders of the municipal intentions in local land use planning, implementation of statutory provisions, and specific local conditions.

The implementation of a centralized liability certification system transferred a majority of responsibilities from the local authorities on to professionals in the building industry (Berg, 2005; Nørve, 2005; Øyen et al., 2005). Thorough control in the building process should fulfil the aim for both a general improvement, and adequate skills.

Public supervision was formalized, leading to changes in municipal tasks relating to the approval processes (Eakin et al, 2011). Although the aim was to reduce the number of defects in planning and constructing buildings (Nørve, 2005; Øyen et al., 2005), moisture and climate adaption were not subjected prior to, nor in, the amendments effectuated in 1997.

[2] The Norwegian Planning and Building Act, LOV-2008-06-27-71, latest amendments of 2012.01.01. The Ministry of Environment and the Ministry of Local Government and Regional Development

3.4 Planning and building legislation: Current provisions

The main purpose of the recent legislative changes has been to simplify an inappropriate, overly complex and unsystematic legislation. A holistic review should provide easier and faster processes as basis for i.a. time use, defects and cost reductions. The latest amendments require that all Norwegian municipalities develop risk and vulnerability analysis. The assessing of local climate conditions and mapping of potential risks relevant to the building stock is an important step to obtain a climate adapted built environment. The strengthening of the climate focus in the latest amendment was primarily driven by research (Lisø and Kvande, 2007) and legislative preparatory work[3,4] emphasizing that climate related issues were lacking in previous versions of the legislation.

The latest amendments of 2008 are aiming at rationalizing the planning and building legislation. A number of newly introduced climate related topics are now included both in the Planning and Building Act, technical building codes (TEK 10[5]), and procedural regulations (SAK 10[6]). Mandatory risk and vulnerability analyses (ROS) conducted by local authorities are introduced, to better ensure climate related aspects in the planning process**Error! Bookmark not defined.**. The building codes state that new buildings should adequately protect against damage or natural stresses through proper building positioning, design and construction. In addition, building site and adjacent terrain should not be exposed to consequential damage or significant risk.

Needed building robustness level is ensured through internal or independent technical control. In each project, local authorities with knowledge of local climate should determine the nature of control and which areas should be targeted. Preliminary meetings in planning projects, preliminary conferences related to the building application approval process, and other policy instruments, are some of different possible arenas for dissemination of such information.

4 Empirical case study findings

As the case study of the BIVUAC project is not yet concluded, empirical findings of the ongoing PhD of one of the authors, and the in-house SINTEF B&I project Climate 2050, are employed to enlighten the different aspects addressed in the paper. The findings of the PhD case study focus on several corresponding and adjacent subjects, highly relevant to the BIVUAC research areas. The findings of the PhD study will therefore provide valuable information relative to elucidate the selected issues in the paper, and is also of great value when executing the BIVUAC case studies.

[3] Ot.prp. nr. 32 (2007-2008) - Odelsting (Legal assembly of the Parliament) Proposition. The law on planning and building regulations (Planning and Building Act - planning section), by the Ministry of Environment
[4] Ot.prp. nr 45 (2007-2008) – Odelsting (Legal assembly of the Parliament) Proposition. The law on planning and building regulations (Planning and Building Act - building section), by the Ministry of Local Government and Regional Development
[5] Current technical regulations/codes, valid from 2010: FOR 2010-03-26-489: Technical regulations regarding technical requirements to buildings
[6] Current procedural regulations/codes, valid from 2010: FOR-2010-03-26-488: Building application procedural regulations

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4.1 Municipalities: Implementation and incorporation of provisions

As opposed to the intentions, few municipalities have so far implemented the climate related issues in of the latest planning and building legislative amendments. The topics are neither reflected in municipal planning, building application procedures nor other policy instruments. Development of mandatory Risk and Vulnerability Analyses (ROS) have to date been initiated only by a small number of municipalities. ROS analyses are of an interdisciplinary character, displaying a cross-section of different areas of the society and its exposure to risk. In this context, ROS analyses should be a foundation for the development of different policy instruments focusing on climate strain and possible climate change impacts for the nation at a general level and for the individual municipality in specific.

Main findings related to municipal planning and processing of building applications are as follows:

- Lacking focus on climate related issues in general and climate change in particular in planning and building sections of Norwegian municipalities. This is most apparent in municipal management; there is a clearer climate related focus at executive levels;

- Lacking development of ROS analyses as basis for other policy instruments;

- Lacking implementation of climate related risk issues and directions in municipal plans, provisions, guidelines, information forums and other policy instruments;

- Municipal knowledge of local climate challenges highly present, but primarily informal, individual, person depending, and non-formalized (oral, not written); and

- Climate adaptation and climate vulnerability concerning building process and property-related issues are by several municipalities seen as strictly professional participants' responsibilities.

The findings indicate that municipalities are falling behind, struggling to update systems and management of law at the same rate as the legislative development. Due to lacking attention to climate aggravations this may implicate ripple effects far beyond the planning and building sector, and could have negative impacts on the built environment in specific, and the social security in general.

4.2 Professional participants of the building process: Climate adaptation in practice

Despite the fact that climate adaptation is not subject to a comprehensive management in the municipal sector, it lately seems to having received greater attention in the private sector among the professional participants of the building process. As the level of building defects still seem to be at a proportionally equal rate as in the previous years, the private sector is however evidently struggling with a persistent problem of building defects' generation.

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Figure 1. Private residence project in construction with weather protection to avoid climate or moisture related building defects during the building process. (Photo: Augustinius J., 2011)

Main findings related to professional participants of the building process are as follows:

- Several new, mandatory tasks of control, surveillance, responsibilities/liabilities, verification processes, forms, etc. are introduced the latest decade. Many have come in addition, instead of as a replacement, for former tasks and working methods. A feeling that the bureaucracy has caught up with the crafts enterprises is widespread among players in the building process;

- The number of building defects is too high, and several are recurring defects. It seems that the players of the building process are not able to learn from own mistakes;

- As moisture and climate strain presently lead to a high number of defects, it is reasonable to question whether the construction industry is capable of adapting to a changing climate;

- Climate change can, for some professional participants (designers and contractors), in itself be a major driver. It may lead to increased focus, innovation and consideration of climate related strain in technical development. In order to avoid cost increase, building defects, claims, insurance rate increase, and a bad reputation, the larger building contractors and organizations tend to have a more distinct focus on climate related issues than in the past. This does not necessarily apply for the smaller companies. However, the harshness level of local climate challenges seems to have an impact on the attention paid to climate adaptation measures; and

- Although the focus on climate change and climate adaptation increasingly appears to be maintained among the players in the building process, new tools to assist professional participants are not correspondingly developed. Considerations to climate

and climate change are to some extent incorporated into existing tools and procedures for design, construction and control. However, it still seems that the players are (as in the municipal sector) relying on informal (personal) climate expertise and that incorporation of local climate challenges largely is based on non-explicit knowledge.

The two latest amendments of the planning and building legislation have been focusing on both simplification and efficiency improvements of the building process. This process has led to a large formal change for the operation of private enterprises operating in the construction industry. Many small businesses have teamed up with other, often larger firms. These operational changes have cleaned up the construction process, but have also led to larger bureaucratic responsibilities for the enterprises. It may seem that the professional participants in the building process to a certain degree have added new statutory responsibilities besides the existing rather than to incorporate and develop new customized routines.

5 Discussion and conclusions

5.1 Discussion

The introductory mapping of the Norwegian planning and building legislation gives a general review of how climate adaptation of the built environment is ensured through the Norwegian planning and building legislation. The legislation deals with organization of the building process, and sets specific functional requirements to the completed buildings. Further, formal requirements to tasks and responsibilities' apportionment, planning and building application processes, control at all stages of the building process, and municipal supervision should ensure a surveyable and orderly building process.

The performance based regulations set requirements for building performance at a general level, where issues including climate change considerations and moisture safety shall be ensured. Climate change aspects are therefore seemingly well incorporated in the current planning and building legislation. Our findings, also supported by previous research, do however demonstrate that climate change is not sufficiently safeguarded in the construction process. The implementation and effectuation of legal provisions by the public and professional participants of the building process must therefore provide an answer to why. The current legislation applies only to a certain extent, existing building stock. The maintenance backlog of existing buildings is large, making the existing building stock even more vulnerable to climate strain and climate change. This subject has however not been approached in this paper.

According to Næss et al. (2005), technical and legal framework will not necessarily ensure the implementation of adjustments of administration and practice needed. Further, O'Brien et al. (2004 B) maintain that fundamental institutional and economic conditions are as important as mere technical adjustments as adaptational strategies in reducing negative impacts and taking advantages of potential positive effects of climate change. O'Brien et al.(2004 B) see institutional interaction, research and development, public administration, and policy and legal frameworks as equally important.

The findings indicate a mismatch between the local authorities' safeguarding of climate adaptation, or lack of such, and the mandatory, bureaucratic tasks players in the

construction industry must follow to operate in the building process without losing their accept responsibility.

Beyond being registered as a responsible player in a specific construction project, contractors are not involved in the municipal planning and building process. This is not a problem as long as the client and/or the designer exercise good practice in providing continuous information from local authorities to all involved stakeholders in the building process. If the local planning and building authorities, as seen in a large number of municipalities, do not perform vital mandatory tasks but leave this to the professionals, both the obtaining and the transfer of information concerning local climate conditions is up to the client and the designer. If the local authorities however do perform risk and vulnerability analyses as intended, the dissemination of vital information of local climate conditions must be safeguarded to all players of a building project by the municipality. This may not always be the case today, especially when considering the low level of risk and vulnerability analyses actually performed. This pinpoints problems both in implementing climate related issues in local authorities' planning and handling of building applications, and in their transfer of information to the building process stakeholders.

5.2 Conclusions

That several of the Norwegian 340 municipalities have not performed or developed risk and vulnerability analyses, as decreed by law, nor communicate climate change and adaptation through their diversity of policy instruments as important issues to regard during the different stages of the building process, is a serious problem. The balance in apportionment of mandatory responsibilities and tasks between local authorities and professional participants of the building process is subtle, yet important in order to achieve a sustainable and robust built environment. The public authorities are also pronounced as role models. When they do not fulfill their obligations, possibilities of others following their example will increase. The difference between large and small enterprises in the construction industry is admittedly large, as is their conduct and attention to climate change and adaptation. However, it seems that at least the larger enterprises have commenced the incorporation of climate adaptation in design, construction and control.

Despite the fact that the amendments should simplify the legislation, and yield a more transparent and predictable building process, as of yet this is not an obvious outcome. It seems that several of the forms are filled out, and operations are performed, just because it is required. In many cases these procedures are not yet incorporated as a natural part of the "new" building process.

The number of building defects due to moisture and climate strain is also still unfortunately too high, even though this is not a direct empirical finding in our study. As many of the municipalities and professionals often do not formalize personal knowledge (so called silent or non-explicit knowledge), this may be one of the answers as to the high number of recurring building defects. Simultaneously, this may be an important future source of knowledge both of local climate challenges, locally adaptive building styles and choice of adequate detail solutions. Increased formalized documentation of experience based competence will enable a broader learning platform.

This will enable learning from each other's mistakes and experiences in a far larger scale than is the case today.

Whether and how the amendments will lead to the obtaining of successful adaptation of the built environment to climate aggravations, is an important question. At present it does not seem that the amendments of the planning and building legislation has had the wanted effect. The findings do however not substantiate that the design of the legislation is not satisfactory, but rather that the local planning and building authorities have not followed the legal changes and new regulatory requirements through the development of municipal plans and policy instruments. This may have several causal connections; staff shortage, lack of funding, still too complex processes, too heavy workloads etc. At this, it is rather a question of enforcing the legislation through incentives or penalties for not following the statutory responsibilities imposed on Norwegian municipalities (and counties that do not follow the local authorities). This is presently the case for professionals, if gravely violating the legal requirements, through withdrawal of their right to accept responsibility.

In conclusion, it seems that the legislation serves its purpose of enhancing the focus on climate change and need for adaptation adequately, but that the implementation of the legal requirements through the local authorities is not correspondingly sufficient. Thus the implementation of legal provisions does not seem to adequately support necessary actions for adapting the built environment to climate change.

Our findings display a need for a thorough evaluation of the effects of the revised legislation implementation and effects on professional practice are needed in order to pinpoint the exact areas of further improvement. Causal connections as of why the local planning and building authorities are not capable of keeping up with the legislative development speed should also be subjected in further research.

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Legislation, standards, and energy certificates in the Mediterranean

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Abstract:
The Energy Performance of Buildings Directive (EPBD) 2002/91/EC introduced various obligatory requirements intended to achieve the reduction of use of energy resources in buildings. This directive had to be transposed into national legislation by the EU member states. Concurrently the European Committee for Standardisation (CEN) developed a number of technical standards to assist member states to define the methodology for the calculation of the energy performance of buildings. Whilst the system and procedures for energy certification in Northern European States are now mature, a number of Southern Mediterranean states have only recently introduced the procedures for the issuance of energy certificates for buildings. This paper presents a comparative review of the relationship between the European directive and the standards, and the different country legislation and methodologies that have been implemented in Malta, Italy, Spain and Cyprus.

Keywords:
Energy certificates, EPBD, Mediterranean states, residential buildings, standards and legislation.

1. Introduction

The European Energy Performance of Buildings Directive (EPBD) 2002/91/EC introduced various obligatory requirements intended to achieve the reduction of the use of energy resources in buildings and, consequently, the reduction of the environmental impact of energy use in buildings. Article 7 of the directive formally specified the current European requirement for the energy certification of buildings. In order to implement this requirement, a general framework for establishing a methodology of calculation of the total energy performance of buildings became necessary. A total of

30 European (EN) standards and 24 international (EN ISO) standards were drafted in order to define the necessary procedures to be introduced following the ratification of the EPBD. In 2010, a recast of the Energy Performance of Buildings Directive 2010/31/EC was adopted by the European Parliament and the Council of the European Union in order to strengthen the energy performance requirements and to clarify and streamline some of the provisions from the 2002 Directive.

Over the years a number of EU member states found difficulty in the transposition of the EPBD and some are still struggling with practical implementation issues (Dascalaki et al, 2012).

Apart from the difficulties in the transposition and implementation of the EPBD, compliance and control are essential for the successful operation of the directive. Three factors have been identified for the effectiveness of a successful compliance and control strategy (Poel and van den Brink, 2009), namely:

- The existing legal and regulatory system in the country. In states where the legal responsibility is delegated to regions, the federal legal structure should facilitate the implementation for the regions. In these states a centralised implementation is unlikely and diversity in compliance and control instruments can occur.

- Cultural aspects related to the interaction between the citizen and the state. In some countries strict enforcement is the common approach, while in other countries control schemes may be based on self-regulation.

- The political and economic policy of the government. The current national objectives might not necessarily coincide with the objectives of the EPBD.

This research examines the implementation of the directive in a number of Mediterranean states, namely Italy, Malta, Cyprus, and Spain. Although a general overview is taken, the focus of this work is on the state of implementation of the section of the directive relating to the energy certification of residential property, as this is the main area of the authors' research.

2. Italy

In Italy both the national and the regional governments are jointly responsible for technical standards and building regulations relating to energy. As a consequence, there are two levels of standards and regulations, a national level that establishes the national minimum energy performance requirements and a regional or local level that could be more onerous.

A different consequence of the regional independence is that a number of regions have not yet implemented a certification scheme (Antinucci, 2011). The majority of these regions are in the South of Italy.

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Legislation

The Energy Performance of Buildings Directive (EPBD) 2002/91/EC was ratified in Italy by two decrees, namely Legislative Decree no. 192 of the 19th August 2005, subsequently amended by Legislative Decree no. 311 of the 29th December 2006, which established the general framework for the implementation of the Directive and updated the performance requirements for new buildings. These were supplemented by Legislative Decree no. 115 of the 30th May 2008 that defines the qualifications of the professionals involved, by Presidential Decree no. 59 of the 2nd April 2009 that defines the technical standards to be used for the calculations, and by a Ministerial Decree issued by the Ministry for Economic Development on the 26th June 2009 establishing the national guidelines for the energy certification of buildings. The Ministerial Decree defines the calculation methodology for the assessment of the energy performance of buildings in accordance with the national standard UNI TS 11300.

Technical Standard

Several CEN documents were adopted as Italian standards. The UNI TS 11300 series of technical specifications was developed to define the national calculation method for determining energy performance of buildings and is divided into four parts:

- Determination of the thermal energy demand of the building in summer and winter;
- Determination of the primary energy requirements for winter heating and domestic hot water production;
- Determination of primary energy requirements for summer air conditioning;
- Use of renewable energies and alternative methods of generation for space heating and domestic hot water preparation.

The standard also defines three different methods for the calculation of the primary energy for heating, cooling and domestic hot water. The first is a detailed method applicable for all building typologies. The second is a simplified method for the calculation of the energy performance of existing residential buildings with a net area below 3000 m^2. The third method is applicable to residential buildings with a net area below 1000 m^2, using a simplified method.

The standard proposes three different types of energy assessment:

- Design assessment: the calculation is performed on the basis of design data whilst assuming continuous operation of the building and the technical systems.
- Standard assessment: the calculation is performed on the basis of the as-built data for the building and the plant, whilst assuming continuous operation of the building and the technical systems.
- Assessment in actual conditions: the calculation is performed on the basis of the as-built data for the building and the plant, whilst assuming the actual operating schedules for the building occupancy and technical systems.

A simplified reference calculation tool, DOCET, was developed by ENEA (the Italian National Agency for New Technologies, Energy and the Sustainable Economic Development) together with ITC-CNR (Construction Technologies Institute – The Italian National Research Council) as a reference energy performance calculation

method for residential buildings. This tool was further developed in 2010 by ITC-CNR into DOCET^{PRO}. The software is based on the simplified monthly method (Belussi et al, 2010).

Implementation

Due to the regional autonomy mentioned earlier, there were a total of ten defined regional systems in 2010, with over two million energy performance certificates (EPCs) issued.

Compliance

Italy is one of the two Mediterranean states currently undergoing infringement procedures in connection with the EPBD. In 2010, the European Commission formally requested Italy to comply with the directive. The Commission felt that Italian legislation on energy performance certificates for buildings did not comply with the requirements of the Directive and that Italy had not adopted any measures regarding the requirement to carry out regular inspections of air-conditioning systems in order to evaluate their performance (IP/10/1561). Again in 2011 the Commission informed Italy about its lack of compliance with the relevant rules (IP/11/1100). Although the Italian authorities had taken additional measures, the Commission considered that the Italian legislation still did not fully comply with the EU requirements. Specifically the Commission felt that the Italian law did not ensure that every new owner or tenant of a building receives information on the future energy costs or recommendations on how to improve the energy performance of the building in a cost-effective manner. Furthermore, Italy had still not put in place the necessary measures to ensure regular inspections of air-conditioning systems. These inspections should ensure the optimal performance of the systems and should include advice on possible improvements and on alternative solutions. Finally in 2012, The Commission decided to refer Italy to the EU's Court of Justice for failure to fully comply with Directive 2002/91/EC on the energy performance of buildings (IP/12/1411). The Commission feels that Italian legislation is not in line with the provisions on energy performance certificate, and that Italian authorities have not yet communicated any implementing measures regarding inspections of air-conditioning systems. An infringement procedure had previously been opened in 2006 against Italy due to the incomplete and incorrect transposition of the Directive. The Commission felt that despite several letters of formal notice and reasoned opinions to the Italian Authorities, the Italian legislation is still not in compliance with the Directive.

3. Cyprus

The implementation of the EPBD in Cyprus is the responsibility of the Energy Service Division of the Ministry of Commerce, Industry and Tourism. The Energy Service division has developed and implemented a certification scheme with a single methodology for both residential and non-residential buildings. Certification of both categories of building became mandatory in 2010.

Legislation

In Cyprus, the transposition of the EPBD into national law was achieved through the Law for the Regulation of the Energy Performance of Buildings of 2006-N.142 (1)/ 2006 and its Amending Law N.30 (1)/2009. Secondary legislation has been issued for the regulation of various aspects of the directive, such as the national methodology, the minimum requirements for energy performance, the certification procedure for

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buildings, the inspection procedure for boilers and air conditioning systems, and the qualifications of experts and inspectors.

Technical Standard

The core of the methodology for the calculation of the annual energy use for space heating and cooling is the monthly quasi-steady state method defined by the EN ISO 13790 standard. In addition, the methodology makes use of a number of other standards developed for the EPBD and outlined in the CEN Technical Report 15615:2008 Umbrella Documents. The actual calculation tool was based on iSBEM (interface for the Simplified Building Energy Model) developed by the Building Research Establishment (BRE) for the Department of Communities and Local Government in the U.K. This methodology was developed further by the BRE in conjunction with the Energy Service Division of the Ministry of Commerce, Industry and Tourism in Cyprus so as to meet the specific requirements of the Cypriot building stock and climate. The software tool provided by the Energy Service Division for the certification is SBEM-CY (Simplified Building Model Cyprus).

The Cypriot calculation methodology relies on the use of a notional building, i.e. a building which has the same geometry, location, building function, and size as the actual building, but with parameters such as insulation values, heating system efficiency, internal gains, etc., substituted by reference values. The methodology performs two calculations, one on the actual building and one on the notional building, the latter providing a benchmark. The ratio of the primary energy of the actual building to that of the notional building is used to provide the classification of the actual building.

Implementation

The requirement for an EPC is linked to the issue of a building permit for construction works through Regulation 429/2006 which makes it mandatory to submit an EPC to the building authority prior to the issue of a building permit. This ensures that an EPC is issued for all new buildings. However it is not obligatory to convert the original EPC, which is a design certificate, to an as-built EPC with actual data on completion of the building. This was thought to involve higher costs for the consumer and be a more onerous administrative burden for the building authorities (Panayiotou et al, 2010).

One of the minimum requirements for the energy performance of new buildings is their classification as a class B or better, implying that the new building should achieve a better energy performance than the notional building, as class B is equivalent to between 0.5 and 1 times the energy performance of the notional building.

Approximately 2000 certificates were issued during 2010 which was the first year of operation of the scheme. A quality assurance scheme operated by the ESD checked 16% of all certificates issued which were flagged as requiring additional verification and just over 30% of these were cancelled (Xichilos and Hadjinicolaou, 2011).

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4. Malta

The implementation of the EPBD in Malta is the responsibility of the Building Regulations Office of the Ministry for Resources and Rural Affairs, although the legal authority is vested in the Malta Resources Authority. The putting into practice of the certification methodology commenced during 2011 and only certificates for residential property have been issued so far.

Legislation

Malta implemented the EPBD by means of Legal Notice 261 of 2008 (Malta Resources Authority Act – Chapter 423) Energy Performance of Buildings Regulations, 2008. This legislation superseded Legal Notice 238 of 2006 but keeps the former technical guidelines on the 'Minimum Requirement on the Energy Performance of Buildings'. The new legislation transposed all of the Directive's clauses to national law.

Technical Standard

The EPRDM (Energy Performance Rating of Dwellings in Malta) methodology for the energy certification of residential property was developed locally by the Buildings Regulation Office in accordance with EN 13790, using the steady state monthly method. The methodology for non-residential property was based on iSBEM, developed by the BRE for the Department of Communities and Local Government in the U.K. This methodology was developed further by the BRE, in conjunction with the Ministry for Resources and Rural Affairs in Malta, so as to meet the specific requirements of the Malta building stock and climate. The software tool provided for the certification of non-residential property is SBEM-MT (Simplified Building Model Malta).

Whilst both methodologies provide an energy rating in terms of kg CO_2 per m^2 of floor area, the energy rating for residential property is an absolute value in numerical terms whereas the rating for non-residential property is a scale from A to G, based on the comparison between the rated property and a notional property with the same geometry, location, building function, and size, but with parameters such as insulation values, heating system efficiency, internal gains, etc., substituted by reference values.

Implementation

Although the EPC is required for the issue of a building permit for construction works, the building authority is not obliged to refuse the issue of a permit if the certificate is not presented. The main drive for the issue of certificates appears to be related to property transfers. The methodology for the certification of non-residential buildings is currently being rolled out and training of experts in the certification methodology commenced in the first half of 2012. Approximately 250 certificates were issued for residential property in 2011.

Compliance and Certification

In the Maltese islands the project architect has the legal obligation to verify that the building design meets or exceeds the national minimum energy performance requirements when submitting an application for new construction to the Malta Environment and Planning Authority (MEPA) and this has been a legal obligation since January 2007. At the same time the owner is obliged to commission an energy performance assessor to produce a design rating EPC for the building. In the case of

large developments MEPA refers the project designs for specific consultation on energy performance and use to the Malta Resources Authority (MRA) among other entities. The MRA has to refer the designs to the Building Regulation Office (BRO) which assesses the project designer's calculations and reports to see whether the buildings meet the minimum requirements. If the latter are not met the BRO sends its feedback to the project architect requesting appropriate revisions.

When MEPA issues the planning permission, the project architect follows on by supervising the project throughout its construction and finishing phases. When the finishing has reached its final stages the owner should commission an energy performance assessor to produce the mandatory EPCs based on the asset rating energy performance. The latter is obtained from calculations that depend on the useful floor area, building function, type of building fabric and external finishes that would at least meet the minimum requirements.

The EPCs are quality checked for accuracy of content and recommendations by the BRO as the central EPC database is held at the same office. The BRO also scrutinises all MEPA applications and requests design rating EPCs from the building owners when applications for building permits are validated and accepted by MEPA.

5. Spain

The implementation of the EPBD is the responsibility of the Ministry of Industry, Tourism and Commerce and of the Ministry of Housing. The Spanish regions are independently responsible for the registration, inspection and control of EPCs. The EPC is valid for a maximum period of ten years. This may be shortened by the individual regions, although none have done so as yet.

Legislation

The transposition of the EPBD in Spain has been achieved through the following Royal Decrees:

- Royal Decree 314/2006 of the 17th March, approving the Technical Building Code (CTE)
- Royal Decree 47/2007 of the 19th January, approving the basic procedure for the energy certification of new buildings
- Royal Decree 1027/2007 of the 20th July, approving the Thermal Building Regulations (RITE)

Legislation for the energy certification of existing buildings is required to complete the transposition of the EPBD but this has not yet been enacted. A draft royal decree was published in 2012 defining the basic procedure for the energy certification of existing buildings.

Technical Standard

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The EPC defines the global energy rating on the basis of CO_2 emitted per unit floor area per annum. For residential buildings, this is compared to a series of reference values that are defined according to the climatic zone and the property type.

The official building energy certification procedure CALENER was developed by IDEA (Institute for Energy Diversification and Saving). The procedure has two versions, one for residential and small non-residential buildings, and the other for large non-residential buildings. The calculation engine for CALENER is the DOE-2.2 program developed by the Lawrence Berkeley National Laboratory and James J. Hirsch and Associates of the United States. The original DOE-2 program was developed in 1982 and predates considerably the CEN standards which define the calculation methods for the EPBD. The program simulates hourly performance of a building and can be compared to the detailed hourly dynamic simulation method defined in EN 13790.

Alternative certification procedures and software are acceptable once they are shown to produce equivalent results.

Implementation

The number of certificates issued is considered to be low, with under 2,000 certificates registered by the end of 2010 (Alvarez, 2011). The EPC is to be performed during the design phase, in order to obtain the building permit. The building energy rating is then confirmed on completion of the construction. The responsibility for compliance and control rests with the regional government.

Control

There are three different laws that could be applicable depending on which part of the regulations has not been fulfilled. If the building does not comply with the requirements specified in the CTE, the applicable law would be the Law 38/1999 for the Ordination of the Building Sector. In this case the different actors participating in the construction process are liable for the defects that compromise the stability of the building during ten years and for defects that compromise its habitability (e.g. insulation, service installations, etc.) during three years. This law obliges the firms or individuals participating in the construction to obtain insurance cover against the possible defects that could arise during the use of the building.

When the building installations do not comply with the requirements specified in the RITE, the applicable law would be the Industry Law (Law 21/1992) which states different penalties ranging from economic fines to suspension of activities.

If the EPC has not been issued according to the building project or the final building the applicable law would be the General Law for the Defense of Consumers and Users (Law 26/1984). This could result in administrative penalties which would not substitute the possible civil or penal responsibilities which will be applicable. The formulation and registration of an EPC does not imply the fulfilment of the CTE and the RITE (Molina and Alvarez, 2010) .

Compliance

Spain is the second of the two Mediterranean states currently undergoing infringement procedures in connection with the EPBD. In 2010, the European Commission formally requested Spain to comply with the directive. The Commission felt that Spain had not yet adopted a methodology for calculating energy performance or a certification scheme that covers all existing buildings and that the Spanish system for the inspection of boilers did not cover installations which existed before the legislation entered into force (IP/10/1561). In 2011, The Commission decided to refer Spain to the EU's Court of Justice for failure to fully comply with Directive 2002/91/EC on the energy performance of buildings (IP/11/1447). The Commission is maintaining that under Spanish law, the adopted methodology for calculating the energy performance of buildings and the requirements for handing over an energy performance certificate are applicable only to new buildings and existing buildings undergoing a major renovation, when the EPBD requires establishing a methodology and certificates for all types of buildings. Furthermore, the Commission considers that Spain still has not put in place the necessary measures to establish a regular inspection regime for boilers

6. Conclusions

Although there is considerable variety in the methodology of implementation of the EPBD in the four countries examined, it is quite clear that there are a number of common difficulties.

Evidently one of the major hurdles has been the actual transposition of the directive into national legislation, with two out of the four countries forming part of this study currently facing infringement procedures for failing to have done so completely, a full eight years after the enactment of the original directive. Whilst it would be presumptuous to assume a complete understanding of the reasons for this alleged failure to transpose the directive, the following could be considered as contributory factors:

- It is clear from all member states that the enactment of legislation for the definition of technical requirements is not straightforward. Despite their purportedly open and available procedures, both science and legality are experienced in popular culture as arcane, impenetrable and often un-interpretable (Silbey, 2008).
- The different requirements of the directive could be perceived to have different socio-economic priorities, and specifically the requirements for inspection of boilers and air conditioning systems were not considered as important as the articles relating to the energy performance and certification of buildings.

Implementation of the directive has been slow to commence, and none of the four countries can claim to have a high level of take-up of the requirement for energy certificates. Whilst this is sometimes considered to be a characteristic ‘southern problem’ of non-compliance with EU environmental law, this view has been found to ignore the general causes of implementation failure and non-compliance which arise from the nature and content of EU policies (Pridham, 1996). Case study on the implementation of different EU environmental policies has indicated that all states face

similar problems of compliance if an EU policy does not fit their legal and administrative structures (Borzel, 2000).

Clearly regional implementation in Italy and Spain is more complex to roll out and enforce than the single region approach taken in Malta and Cyprus, albeit for significantly smaller countries. Regional differences in implementation within a country may complicate enforcement and diminish the level playing field.

From a technical viewpoint the countries all made use of the CEN standards and/or existing technical solutions in order to develop the national methodology. Different approaches to compliance and control have been taken. The most demanding sanction is generally to obstruct the process of construction or utilisation of new or majorly renovated buildings by withholding the building permit. The effectiveness of this approach strongly depends on the type and scope of control. In view of the relative newness of the various certification systems, the effectiveness of the control systems cannot be assessed at this stage.

All member states are undergoing a review of their existing EPBD legislation in order to meet the new requirement of the EPBD recast. It is likely that the Mediterranean states can benefit as their relatively newer structures are more flexible to the modifications required by the recast. The authors are currently researching the different certification methodologies applied in Southern Europe (Malta, Italy, Spain, Cyprus) in order to establish whether these provide an accurately calculated value of energy demand in Southern Mediterranean housing. As outlined in the above paper, the application of these certification methods is relatively recent and with the implementation of the recast EPBD, and the revision of the CEN standards on which the methodologies are based, it is opportune to analyse the existing procedures and identify their strengths and weaknesses.

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Planning Law in England and Wales: Sustainable Development and the Localism Debate

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Abstract:
At a time when 'localism' is very much on the UK government agenda, it is appropriate to reconsider the influences underpinnning planning law. Sustainable development has become a forceful legal principle and is expressly acknowledged in the planning regime of England and Wales and the shift towards more public involvement at a local level is now enshrined in legislation[1]. There are tensions apparent between previously identified ideologies and these newer phenomina. This paper examines the development and respective dominance of these ideologies. It also considers how the competing ideologies may fare, in the context of the climate change imperative and the current economic downturn.

Keywords:
Environment, localism, planning, public participation, sustainable development.

1 Introduction

The traditional title of the discipline 'Town and Country Planning' speaks of its origins and the notion that planning was, at its inception, primarily concerned with the control of urban development. The planning system in England and Wales certainly did not evolve with any acknowledgement of a role in environmental protection. Indeed, traditionally, environmental considerations were largely ignored. 'Town Planning' has more recently been defined as anything that 'relates to the character or the use of land'[2]. This exceptionally broad reach makes a powerful tool of the planning system. A tool, which has, over the years, increasingly served environmental interests.

Whilst acknowledging that environmental law and planning law are separate disciplines and distinguishing between pollution control and the planning system, the government sees the two systems as 'separate but complementary'[3]. It makes practical sense to recognise that these are interrelated disciplines (Owens, 1994 p 439), but the boundaries between the two are in reality fraught with complexity (Thornton, 2008 p 609). It is hard enough to reconcile the ideologies that underpin planning law (McAuslan, 1980)

[1] *The Localism Act*, 2011 c.20.
[2] *Westminster City Council v Great Portland Estates Plc* [1985] AC 661, per Lord Scarman.
[3] Planning Policy Statement (PPS) 23: Planning and Pollution Control, Para 10.

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and when environmental principles and ideologies are added to the mix, the tensions are even more clearly apparent.

Set the conflicting principles and ideologies against a scene that includes the urgency of the climate change imperative and economic crisis and an interesting picture emerges. In 1980, McAuslan identified three competing ideologies underpinning planning law; 1) The law exists to protect private property 2) The law exists to advance the public interest 3) The law should be used to advance the cause of public participation (McAuslan, 1980 p2). Since then, it is argued, two further significant ideologies have emerged; those of sustainable development and localism. These compete with each other and the traditional ideologies of planning law identified by McAuslan. This paper considers the development and respective dominance of the five ideologies over the period of existence of 'Town Planning' in England and Wales, concluding with an analysis of the current position and some thoughts on the implications for planning and the environment.

2 The Traditional Common Law Approach

The first of McAuslan's ideologies will be familiar to all legal scholars. It is an approach to the law which flows from the close relationship between private property ownership and the law. Historically the two have always been closely intertwined. The idea that the role of law was to uphold the constitution and property can be traced back to Locke in the seventeenth century (Locke, 1690). Until more recent times politics and law making were the exclusive preserve of property owners. It was also the case that the judiciary and lawyers were, themselves, owners of property and steeped in a legal tradition that long predated the advent of legislation and judicial intervention to protect the public good.

When faced with legislation enacted to improve the living conditions of the urban working classes and giving government powers to control the use of property, it is not surprising that land owners turned to the courts to protect their interests, nor that the courts were sympathetic to their cause (McAuslan, 1980 p3). It is in the principles developed by the courts in the late nineteenth and early twentieth centuries to protect landowners that the common law or private property ideology of McAuslan's can be recognised (see also Roberts, 1976 p5). The importance of preserving property rights continues to occupy a key position in planning law and policy as demonstrated by the presumption in favour of development enshrined in the new National Planning Policy Framework.

3 The Public Interest Ideology

Alongside the traditional common law approach another ideology has gained influence in recent times. The public interest ideology can itself be traced back in time to the writings of Bentham in the late eighteenth century (Bentham, 1780). This view of the law sees its role as one of providing legitimacy for action taken in the public interest (McAuslan, 1980 p4). Whereas the private property perspective can be recognised in the arguments of lawyers and decisions of the courts, the public interest ideology is evident in the actions and decisions of the public administrator. In order to serve the public

interest the law gives wide powers to administrators, which often give rise to conflict with the traditional rights of private property ownership. In more recent times, the courts themselves have come to recognise the legitimacy of administrative action in the public interest. With the advent of the twentieth century, lawyers and judges began to become familiar with the role of morality in law espoused by Bentham and this acceptance of the public interest ideology can be recognised in the case law of the higher courts in the early 1900s[4].

Planning law is characterised by legislation on land use planning that is motivated by the public interest ideology but yet often attempts to recognise the interests of private land owners (for example, by way of appeal against a planning determination). Planning disputes in the courts see a vacillation between the traditional common law approach and the recognition of the legitimacy of the actions of public officials in the interest of the public who act in good faith and are ultimately accountable to Parliament (McAuslan, 1980 p4 – 5). The conflict between these two ideologies proposed by McAuslan is by no means new and nor is it the case that the traditional common law approach has lost sway over the years.

4 Public Participation

The third ideology identified by McAuslan rests in the proposition that, inherent in the law, should be mechanisms for the public to be consulted and involved in decision making processes. Although, as McAuslan (1980 p5) notes, this ideology also has philosophical roots in the writing of J.S.Mill (1861), it has only become a recognisable force with its own constituency over more recent years. At the time of writing in 1980, McAuslan saw this ideology as of equal importance to the two outlined above, but as the least developed in terms of both policy and law (McAuslan, 1980, p5). As will be illustrated below, this third ideology has grown in substance in these respects in the past thirty years or so.

The basic premise of the principle of public participation in the context of planning law is that the public should have rights of participation in decisions on land use planning, not because of any property interests but in the interests of democracy and justice (Lucas, 1976). This notion naturally brings the ideology of public participation into conflict with the private property/common law approach. It also does not sit comfortably with the public interest ideology. Public administrators acting in the public interest in accordance with the law can tend to do so in a paternalistic way without necessarily allowing meaningful public participation in their decision making.

4.1 The Development of Public Participation

The public participation ideology is worthy of further attention here on a number of counts. Whereas what is meant by the private property and public interest ideologies is quite clearly understood, the meaning of public participation is less so. Also, as mentioned previously, there have been significant developments in both policy and legal terms since 1980. This has particularly been the case in respect of environmental

[4] *Board of Education v Rice* [1911] AC 179; *Local Government Board v Arlidge* [1915] AC 120.

matters and it is through the lens of environmental sustainability that this paper views the planning regime.

4.1.1 The Spectrum of Public Participation

Public participation can range from transparent procedures at one end of a spectrum to direct involvement in law-making and even litigation[5] at the other (Lee, 2003 p113). McCracken and Jones (2003) place participatory activities into three categories; 'proactive' (for example, environmental impact assessment), 'active' (for example, the keeping of registers and responding to requests for information) and 'passive' (for example, data monitoring and publication via the internet). Whilst Black (2000) identifies a range of participation extending from 'thin' such as transparent procedures and traditional consultation exercises to 'thick' encompassing deliberation and consensus based decisions and solutions. Thus, it is possible to identify a ladder of public participation (Arnstein, 1969) as illustrated below;

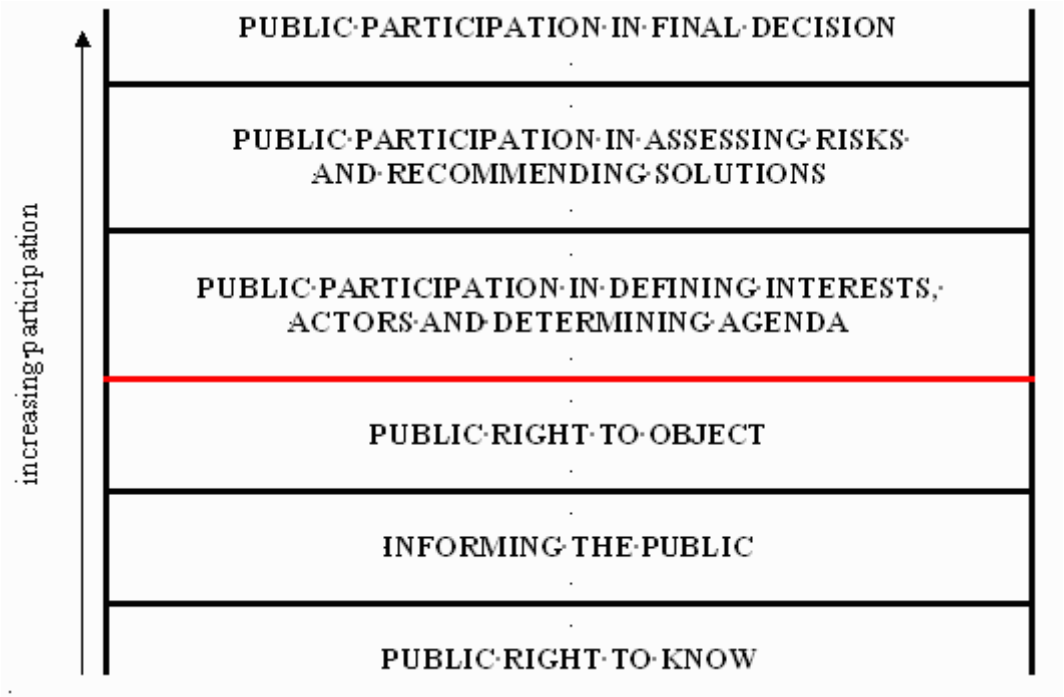

Figure 1. The Public Participation Ladder
(Adapted from Wiedemann and Femers, 1993)

It is clear that the greatest areas of conflict between the public participation ideology and those of public interest and private property will arise with the types of participation towards the top of the ladder. Private property interests will not wish to see affected members of the public involved in decisions relating to their property and nor will public administrators wish to devolve their decision making powers to the uninformed public.

[5] By way of judicial review of a public body's decision.

4.1.2 The Entrenchment of Public Participation in Law and Policy

Whereas at the time of McAuslan's writing, the public participation ideology was arguably underdeveloped, it is now very much a part of overarching law and policy at both supranational and national levels. Freedom of information in environmental decision-making, an essential pre requisite and cornerstone of public participation, has been a feature of EU Law since a 1990 Directive[6]. Since this time, there has been a series of EU Directives containing provisions for procedures informing or enabling the public. Furthermore, public participation is a recurrent theme in EU policy making and this can be noted in the Environmental Action Programmes as well as the EU Governance White Paper[7].

One of the most significant recent developments in the field of public participation is the Aarhus Convention[8]. The Convention implements principle 10 of the Rio Declaration on the Environment and Development and is commonly described as comprising of three pillars, public access to environmental information, public participation in environmental decision-making and public access to justice in environmental matters. The Aarhus Convention goes beyond pre-existing legal provisions and traditional procedures for the provision of information and consultation in quite a number of ways. In particular, the Convention provides for a broad range of decisions requiring the participation of the public. It is clear that the spirit of Aarhus is one of banishment of secretive decision-making and the provision of real opportunities for the meaningful engagement of the public, resulting in tangible input into the ultimate decision.

Both the European Union and the UK have implemented the Convention. It is clearly the case that planning law in England and Wales falls within the remit of the Aarhus Convention and despite the fact that there is some doubt cast on the adherence of UK planning law and procedures with the convention (Purdue 2005), the public participation ideology is now well-established in this context. Public participation in the planning process manifests itself in two areas; in plan development and in development control. At the plan development stage public participation was evident as early as 1968 when the 'new style' development plans were adopted and is present today in the participation opportunities offered by the forum of the Public Examination. In terms of development control, public participation remains central to Part I of the Town and Country Planning Act, 1990 (Miller, 2002 p7) and can be recognised in publicity requirements and opportunities for the public to make representations as well as in Public Inquiries into major projects. Furthermore new mechanisms for more participatory and deliberative process have been mooted and trialled in, for example, waste site plans. These include Citizens' Juries and Community Advisory Committees (Petts, 2002 p193).

[6] Dir 90/313/EEC on Freedom of Access to Information on the Environment [1990] OJL158/58 (subsequently repealed by Dir 2003/05) implemented by Environmental Information Regulations, 1992 (SI 1992/3240) (UK).
[7] European Governance – A White Paper, COM (2001) 428 25 July, 2001, 8.
[8] Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, Aarhus, Denmark, 25 June 1998 (entered into force 30 Oct. 2001).

5 Sustainable Development

It is argued that since 1980 further key ideologies have developed that are influential in planning law and procedure. In the past thirty years or so, the principle of sustainable development has become prominent in all areas of law making. Whilst there remains some debate surrounding the legal enforceability of the principle (Bell & McGillivray, 2008 p 60. Hendry, 2005), it is submitted that there is an increasingly dominant viewpoint that the purpose of law (particularly in the environmental and planning spheres) is to ensure sustainable development.

5.1 The Emergence of Sustainable Development

The sustainable development ideology is rooted in more recent times. The principle can be traced back to the 1972 United Nations Stockholm Conference on the Human Environment, but its most commonly accepted formulation derives from the 1987 Bruntland Report;

'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs'[9].

5.1.1 The Meaning of Sustainable Development

What the principle means has been the subject of long debate (see for example, Stallworthy, 2002, Owens and Cowell, 2002, 2011). It is notably anthropocentric, looking primarily to the needs of mankind rather than the environment, flora, fauna and ecosystems and strives for equity both between current and future generations. There are three (often conflicting) interests to balance in attaining the goal; the environment, society and the economy. The principle is often broken down into four key components; inter-generational equity, sustainable use, intra-generational equity and integration. This latter element is one of the most problematic, particularly in terms of integrating environmental and economic policy (Gibbs *et al*.1996, 1998).

[9] Report of the 1987 Wold Commission on Environment and Development 'Our Common Future' (The Brundtland Report).

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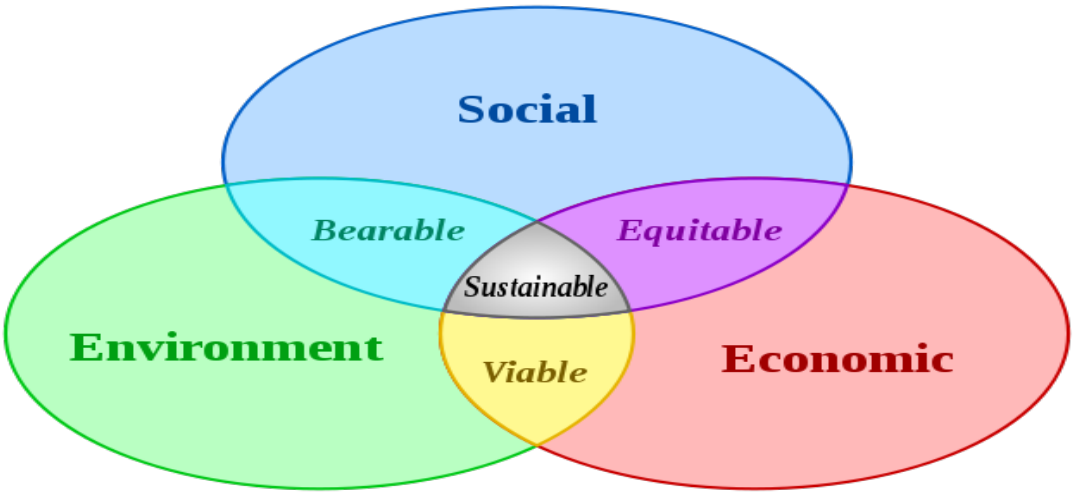

Figure 2. Sustainable Development
(Adapted from Johann Dréo, 2006)

Pure proponents of sustainability argue that the two component terms of the principle represent an oxymoron in that development can never be sustainable. Those who favour a strong application of the principle of sustainable development maintain that the principle does not allow for any diminution of our natural resources, whereas those arguing for a weak version of the principle maintain that resources can be replaced and technological solutions for provision for future generation can be found (Jacobs, 1999). As Owens and Cowell (2011) note in their follow up publication to the seminal work on sustainability and planning (Owens and Cowell, 2002) 'interpreting sustainability could never be a formulaic or purely functional matter: it involved ethical and political choices over which people frequently disagreed'.

5.1.2 The Entrenchment of Sustainable Development in Law and Policy

The arguments surrounding the essence, achievability and legal force of the principle continue to be rehearsed aplenty, but what is evident is the fact that sustainable development has found its way into law and policy at all levels over the past 30 years. The principle is enshrined in the Rio Convention in its Agenda 21[10] and has a prominent place in the EU Treaty;

'The Union shall establish an internal market. It shall work for the sustainable development of Europe based on balanced economic growth and price stability, a highly competitive social market economy, aiming at full employment and social progress, and a high level of protection and improvement of the quality of the environment. It shall promote scientific and technological advance.[11]'

[10] Earth Summit, 1992.
[11] Art 3 (3) TEU.

In England and Wales, sustainable development constitutes the principle aim of the Environment Agency[12] and it is firmly ensconced in policy terms, through both the development of a national strategy[13] and local Agenda 21 initiatives. Although there is an acknowledged close relationship between environmental law and planning law (see earlier), there is no overarching obligation to take into account environmental considerations in the planning process. Environmental considerations can be material, particularly if a conservation site is involved or EU law principles prevail. However, sustainable development has been an integral part of planning law for some time.

Section 39 of the Planning and Compulsory Purchase Act, 2004 states that all plan making bodies are to exercise their functions 'with the objective of contributing to the achievement of sustainable development'. In addition two of the key former Planning Policy Statements provided guidance on sustainable development in planning[14]. In a highly controversial move, the new coalition government has now introduced a presumption in favour of sustainable development in the new National Planning Policy Framework (NPPF)[15]. The NPPF definition of sustainable development reflects the Bruntland definition (above) within a planning context. It is articulated as 'planning for prosperity, for people, and for places'. Thus it embraces the economic, social and environmental elements of the Bruntland formulation (Brearley, 2012).

6 Localism

McAuslan (1980) identified public participation as an emerging yet important ideology. It is argued that, in the second decade of the 21st century, another such developing ideology is identifiable. Although it has a close relationship with public participation, localism is a separate concept. Whereas public participation refers to the involvement of the public, to varying degrees, in decision making at a number of levels; it is argued that localism is concerned with where decisions are made. It is in fact an iteration of the principle of subsidiarity, embraced by the European Union over recent years. In simple terms, the principle dictates that decision making should take place at a level where it is most effective and that decisions should only be made at the higher level when this is to best effect. The principle also has its roots in philosophy and can be traced back to Aristotle and St. Thomas Aquinas as well as being recognisable in the nineteenth century in the work of Proudhon (1863) and J.S. Mill (1861). Mill's view was that 'It is but a small portion of the public business of a country which can be well done, or safely attempted by the central authorities'.

6.1 The New Localism

The localism agenda is very much at the forefront of the current UK coalition government's policy. Support for deregulation and liberalisation have been apparent in Conservative Party policy from the 1940's onwards and this traditional support for economic liberalisation is now coupled with a decentralising ideology (Bullock, 2011). In July, 2010, the Department for Communities and Local Government (DCLG)

[12] Environment Act, 1995 s4.
[13] National Strategy on Sustainable Development (HMG, 1994).
[14] Planning Policy Statement 1 (2005) Delivering Sustainable Development; Planning Policy Statement 9 (2005) Biodiversity and Geological Conservation.
[15] National Planning Policy Framework, March 2012, Department for Communities and Local Government.

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announced; 'Our ambition is localism. Real change driven by local people working together in their communities'. A radical reform of the planning system was promised with the devolution of greater powers and a return of decision-making powers on housing and planning to local councils[16].

A Decentralisation and Localism Bill was forthcoming and in due course the Localism Act received Royal Assent on November 15, 2011. The DCLG maintains that the Act 'will trigger the biggest transfer of power in a generation'. There are a wide range of planning- related measures in the Act, including the introduction of a new right for communities to draw up a neighbourhood plan, a community right to build and the requirement to consult communities before submitting certain planning applications. The Act also gives the government power to require that money raised from the Community Infrastructure Levy goes directly to neighbourhoods. In addition the Act abolishes regional strategies and the Infrastructure Planning Commission (previously responsible for nationally significant infrastructure projects).

Localism is clearly of importance to the government of today in the United Kingdom, but it is not a new ideology. Ideas of decentralisation and decision making taking place at the most effective (and most local level) have existed over a long period of time and many policy areas have vacillated between central control and decentralisation over the years. Important questions surround just what is 'local' in the current thinking. Rhetoric seems to suggest it refers to quite small scale local community groups but what of local government and regional bodies? The concept of localism is now explicitly recognised in both the name and content of legislation as well as in the significant new National Planning Policy Framework. It will no doubt have a role to play, both in future legislative provisions and in the courts. It could be posited that a purpose of law in the planning sphere is now the decentralisation of decision making or in the current government's language, returning power to the people (Le-Las and Shirley, 2012).

7 Contemporary Influences

If it is accepted that there are now five recognisable ideologies that influence planning law, then a yet more complex picture emerges of how these conflict with each other. Some initial observations on this are put forward in the conclusions below. It would seem reasonable to suppose that the respective dominance of one ideology at one given time will be subject to external factors and pressures. For example, as suggested above the powerful force of property ownership may explain an era characterised by private interest in the nineteenth century, whilst the modern administrative state gained influence in the post-war period allowing the public interest ideology to surface. (Le-Las and Shirley, 2012). A general rise in environmental consciousness has also, no doubt, shaped the growing trend towards public participation. There are two contemporary issues that are worthy of examination in terms of their influence on the complex balance between the underpinning ideologies. These are climate change and the economic crisis.

[16] Department for Communities and Local Government, Draft Structural Reform Plan, July 2010.

7.1 Climate Change

Whilst the recognition of the possibility of climate change is not new (The Royal Commission on Environmental Pollution referred to global warming in its first report of 1971), it is only more recently that the problem has been widely acknowledged as an imperative for action. The most recent report of the IPCC (Intergovernmental Panel on Climate change) finds that there is a greater than 90% chance that increases in global temperatures are man-made[17]. Although scepticism and debate continues, action has been taken at international, regional and national levels.

The Kyoto Protocol to the UN Framework Convention on Climate Change[18] sets binding targets for green house gases for the developed nations and the EU has set even more stringent targets for its member states. A new package of legislation published in 2009 implements the EU targets of producing 20% of energy from renewable sources, 20% reduction in green house gas emissions and 20% reduction in primary energy use by 2020. At national level, the UK Climate Change Programme was launched in 2000 to meet the green house gas emission reduction targets and the UK also introduced its own goal of reducing carbon dioxide emissions by 20% on 1990 levels by 2010. In 2008, the UK became the first nation worldwide to introduce a legally binding long term framework to cut carbon emissions. The Climate Change Act, 2008 imposes a statutory duty upon the Secretary of State of 2050 'to ensure that the net UK carbon account for the year 2050 is at least 80 per cent lower than the 1990 baseline'[19].

On the face of it, the climate change imperative would seem to be most influential in promoting the sustainable development ideology. Indeed, this is probably the case and not just in promoting the environmental limb of the principle. As noted by Owens and Cowell, (2011 p2) facilitating certain types of development (for example wind farms) is crucial to countering climate change. The relationship between the centralism/decentralism debate and the thrust to meet carbon emissions targets is, on the other hand, by no means clear cut. On the one side, government appears to favour central control to enable the ambitious targets to be met (for example by legislating for central binding targets and using the building regulation framework to control emissions from buildings) and on the other to encourage local community initiatives and incentive-based policies, for example, for renewable energy. Walter (2012) questions how the central steering of renewable deployment will meet the carbon budgets without targets for local authorities and doubts that the government's dual commitment to both onshore wind and localism can be achieved.

Similar uncertainties surround the impact of the climate change imperative upon the traditional ideologies of private property and public interest. The conflict between the two ideologies is arguably eroded when private property interests in development of land, for example for wind farms, could also serve the public interest in reaching targets and averting climate change. Conversely, private property interests of a 'NIMByist' character could gain the support of the law and mean a strengthening of the traditional

[17] IPCC Fourth Assessment Report: Climate Change 2007: Synthesis Report.
[18] Kyoto Protocol to the United Nations Framework Convention on Climate Change (adopted 10 December 1997, entered into force 16 February 2005) 37 ILM 22.
[19] Section 1.

common law approach as well as being detrimental to the climate change project and the public interest.

As noted above, the public participation ideology has grown in strength over the past thirty years and procedures for participation are now inherent in the planning process. On the one hand this could be seen to benefit the climate change agenda by harnessing local knowledge and resulting in better decision-making. However, fast action is required to avert global warming and there is some doubt as to whether any speeding up of the system can be accompanied by enhanced public participation (Brearley, 2012). Thus the impact of the climate change imperative upon the public participation ideology is also uncertain.

7.2 The Economic Crisis

The period from 2008 to date has seen a global financial crisis not encountered since the Great Depression of the 1930's. The UK has responded with punishing austerity measures and the economy has now slipped into a double dip recession. It is inevitably the case that in such pressing times when the public is subject to immediate or imminent hardship, goals such as addressing the climate change issue and involving the public in decision making may seem to hold less importance. The imperative of stimulating economic growth is bound to be paramount. Fundamental to this will, of course, be vigorous efforts to encourage and reinvigorate development. The UK Government's March 2011 budget[20] and the parallel *Plan for Growth*[21] identified the planning system as one of the five key restrictions on growth in the UK and measures to change the planning system to address this have already been introduced in the Localism Act[22]. The pressure brought to bear by attempts to pull the nation out of recession and address the financial deficit has already brought notable shifts in the balance between the ideologies identified above.

As previously noted, there are two facets to the private property ideology. One manifestation is in the protection of the rights of private property interests to develop their land and the other is in the protection of property owners from unwelcome adjacent development. The controversial introduction into the new National Planning Policy Framework (NPPF) of a presumption in favour of sustainable development, it is argued, signifies a shift towards the first of these manifestations of property interests. This, no doubt, is primarily a response to the need to facilitate development mentioned above and it is predicted that this provision will mean a presumption in favour of development in almost all cases. According to the NPPF, this is to be the case unless the adverse impacts of doing so would significantly and demonstrably outweigh the benefits[23]. The Secretary of State has already signalled the government's intention to give significant weight to growth in planning decisions (Bullock, 2011). Some are of the view that the consequence of the new presumption will be the erosion of the second manifestation of the property ownership ideology as this is subsumed into the public good (Brearley, 2012). In other words, development will proceed regardless of the

[20] HM Treasury, Budget 2011 (HC 836, March 2011).
[21] HM Treasury, BIS *The Plan for Growth* (London: March 2011).
[22] Supra at No 1.
[23] Supra at No. 15.

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rights of private property ownership where this is in the public interest and clearly development in the current economic climate would seem to serve the public interest.

This leaves an interesting position in respect of the private interest versus public interest nexus. Whilst one element of the property ownership ideology has been strengthened, the public interest ideology has also gained in force at the expense of those property ownership interests affected by proposed developments. On the face of it, the introduction of the presumption in favour of sustainable development would seem to strengthen the sustainable development ideology. However, it is clear from the *Plan for Growth* that the presumption should be interpreted as usually providing the go ahead to all forms of development. Questions of a social or environmental nature appear to be secondary. This is recognisable in the watering down of the zero-carbon definition, for example (Ellis, 2011).

As its name suggests, the Localism Act, on the face of it, promotes the decentralist ideal. Government saw it as essential to attaining the investment and growth necessary to emerge from the recession to move away from the centralised bureaucratic planning system to the 'bottom up' approach of 'Open Source Planning'[24]. As mentioned above, the Act contains a list of measures aiming to give local communities a greater voice in planning issues. However, tensions are already emerging between this localism system and the need for growth as articulated in the recently published government plan (Bullock, 2011, Clark, 2011). There is always the possibility, that the effect of the Act, far from improving the system and enhancing growth, will in fact hinder development by providing traditional Tory voters in the party's rural heartlands the opportunity to use it as a NIMBY charter (Bullock, 2011). Whether or not this is the case as Bullock (2011) notes 'localism and growth can make uneasy bedfellows'. Certainly, at first blush, the Act promotes the ideology of localism to new levels. However, the procedures therein are complex and it remains to be seen how many local communities take up the opportunities to be involved in the planning process. As Clark (2011) points out, the Act raises numerous practical issues that will place additional pressure on local authorities and developers at a time when resource is limited. Whether, in fact, the new measures will lead to any real entrenchment of decentralisation in the law remains to be seen.

As responding to the imperative of climate change requires fast movement, so it is argued, does action to stimulate economic growth and development. Thus it may be that lengthy and unwieldy public participation procedures will also suffer in the quest for economic recovery. This trend is already recognisable in the new provisions for major infrastructure projects in the 2008 Planning Act and it is likely to be accentuated by the abolition in the Localism Act of the Infrastructure Planning Committee and the allocation of its functions to the Planning Inspectorate.

[24] Conservative Party, *Open Source Planning* (London, February 2010)

8 Conclusions

This paper forms just the start of a larger research project. A framework has been identified to apply to further examination of planning law and policy. At the time of McAuslan's writing, the public participation ideology was newly emergent and weak. McAuslan (1980) considered a number of areas of planning law in coming to his conclusion, which, in summary, was that the private property and public interest ideologies worked together to maintain a *status quo* always ultimately framed in the terms of private property and that the future for the development of participative democracy was somewhat bleak (McAuslan, 1980 p145, p274).

There can be no doubt that the public participation ideology has grown in strength significantly over the past 30 years. In addition the related but separate ideology of de-centralisation, or localism, has come to the fore and is now readily recognisable in legislation. The ideology of sustainable development in many respects plays out the conflict between private interest public interest and public participation. These three conflicting ideologies can be mapped against the three pillars of sustainable development; economic, social and environmental. What is clear, however, is that the principle of sustainable development now has its own separate manifestation as a goal of law.

Also self-evident is the fact that prevailing imperatives and pressures will influence the balance between the conflicting ideologies. In this paper just two such contemporary influences (climate change and economic crisis) have been considered and some tentative suggestions have been made as to how the respective positions of the previously identified ideologies might be shaped by these external factors. The next stage of the project will be the selection of certain specific areas of planning law and policy. Then, following in the footsteps of McAuslan, these will be examined in depth utilising the extended framework developed in this paper. The ideologies referred to here can be recognised as underpinning many areas of state regulation. The conflict between them is identifiable in environmental regulation as well as in housing, public health and health and safety law. The focus, for the moment, will be upon planning, but, as here, the analysis will be conducted very much through the lens of environmental protection. It is predicted that an interesting, if complex, picture will emerge.

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Regulatory challenges of building CCS pipelines for cross-border transportation

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Abstract:

Carbon dioxide capture and storage (CCS) is a relatively new technology in the context of climate change mitigation strategies. Its legal and regulatory implications are not yet wholly developed. It is essential to identify legal gaps and obstacles that still need to be addressed. There are challenges raised in the field of building regulatory issues as well: these include for example regulation of transport. This paper takes a brief comparative look at the regulatory principles, especially in the European Union (EU) from the point of view of CCS favourable regulating instruments when trying to support CCS technologies. Remarkable legal developments and creating an effective fit for purpose regulatory regime are crucial steps towards to the more large scale utilization of CCS and cross-border transport of CCS.

Keywords:
CCS, regulations, pipelines, cross-border transportation

1 Introduction

1.1 CCS Regulative Basis and Objectives

In the 2007, CCS was accepted as a climate change mitigation option within the Kyoto Protocol[1]. In addition, legal barriers to the storage of CO2 in geological formations under the seabed have been removed through modifying the London Protocol and the OSPAR Convention. In 2006, amendments to the London Protocol allowed and regulated the storage under the seabed of CO2 from capture processes. In 2007, the contracting parties under the OSPAR Convention also adapted amendments that allowed the storage of CO2 under the seabed. The EU Directive (Directive 2009/31/EC) on the geological storage of CO2 was adopted by the European Council on April 6, 2009 and entered into force on June 25, 2009. The Directive sets out a regulatory regime for permitting of exploration and storage. The Directive applies to projects with

[1] The Kyoto Protocol. Adopted in Kyoto, Japan, on 11 December 1997;entered into force on 16 February 2005. The United Nations Framework Convention on Climate Change.Produced at the United Nations Conference on Environment and Development in Rio de Janeiro from June 3 to 14, 1992.

intended storage of more than 100 ktonnes of CO2. The Directive gives Member States until 25 June 2011 to transpose it into their respective national laws.

The aim of the project is to study the requirements for the development of a large-scale CO2 transport infrastructure in Europe, between 2020 and 2050. The most important conclusions are related to the finding that the EU CCS transport infrastructure is to be led by a relatively small number of countries, who share the largest burden in the areas of CO2 capture, transport and storage. These include the countries bordering the North Sea, and those countries relying heavily on coal or lignite for their power supply (Germany, Poland the Czech Republic). It is crucial that these countries take the lead and are supported to do so, not only now, but during the whole CCS infrastructure development.[2]

The objectives of CCS are clear: CCS must be able to safely sequester large amounts of carbon dioxide (billions of tonnes) for a long time (hundreds to thousands of years). In order to abate atmospheric CO2, CCS should maximise CO2 emissions avoided. To achieve these objectives, CCS regulation must:
- Establish a framework encouraging responsible operation and investment;
- Balance stability and predictability with flexibility and adaptability to new scientific information;
- Provide ease of implementation for both regulators and industry.

CCS regulation must manage the risks and liabilities of CCS, distinguishing between risks that should be assumed by the operator, those that can be mitigated through regulation, and those that can be transferred. However, risk and liability are not the only drivers for CCS regulations. Issues related to competition, climate regime commitments, tax policy, financial responsibility, property rights and international treaties will also shape the CCS regulatory framework. For some risks, the most stringent rules may not come from government at all, but instead from the private sector, such as the insurance industry.[3]

1.2 CCS Regulative challenges in Practise

For practical implementation, CCS will need to be regulated as an industrial process, with regulations geared to each project stage: capture, transportation, site selection and permitting, site operations, site closure, and long-term stewardship. While all the elements of this industrial process exist, they are not yet developed to scale nor are they integrated. The structure of the future CCS industry could take a number of possible forms in terms of the relationships between CO2 producers, CO2 pipeline operators, and geological storage site operators. This policy brief does not cover regulatory issues related to capture but it is worth noting that, while the long-term potential for CCS lies in capturing CO2 at fossil-fired electric power plants, significant short-term potential lies in other industrial processes that already generate a concentrated CO2 stream, such as natural gas, ammonia, or hydrogen production. Regulation of transport and geological storage must be designed to manage CO2 from both electric utilities and

[2] European Commission: Developing a European CO2 transport infrastructure (2011).
[3] Roggenkamp, M., Haan-Kamminga, A.: Transportation of CO2-Legal Considerations. In book "Carbon Capture and Storage, Emerging Legal and Regulatory Issues"(2011). Oxford and Portland, Oregon. P.107-122.

from these other industries. As each CCS project site will be unique, the characterisation and management of geological and technical uncertainty – shades of grey as opposed to black and white – requires methodologies and technologies tailored to the particular circumstances and risks of each site.[4]

1.2.1 Site characterisation

Careful site selection is the single most important way to manage short- and long-term risks of CCS. Establishment of generalised CCS siting guidelines that can be customised to local geology is an important first regulatory step that can be immediately undertaken. Such efforts are underway in Australia,
the US, Canada, and throughout the EU. The site characterisation phase will extend into site development. Installation of injection wells and monitoring systems will add detailed understanding of site geological features.

1.2.2 Site operations

Regulation of site operations will centre on pipeline transport, injection, and monitoring. Most CCS projects will require pipeline transport from source to sink. Regulatory requirements regarding injection will shape the industry by specifying parameters such as injection well design, allowed injection quantities, reservoir pressure limits, purity of CO2 stream, and financial responsibility standards. Current regulations cover some of these, but modifications are needed to adequately manage the risks of injecting large volumes of buoyant CO2. Additionally, monitoring must verify that sites are performing as expected. Establishment of general monitoring and verification (M&V) requirements will be useful to both industry and regulators
but, given the heterogeneity of both capture systems and geology, each site's M&V regime will need to be site-specific and adaptive over time. Extensive baseline measurements before injection will be essential. Technical requirements will not be the only driver for M&V regulations, as the monitoring of results is also important for public acceptance. Large-scale CCS deployment cannot proceed until extensive pipeline infrastructure is in place. Large volumes of CO2 – a 1,000 MW coal-fired power plant produces 5 to 8 million tonnes of CO2 annually – will need to be transported from source to sink. Linkages are complex, and the business model for pipeline operators includes significant risk, as their operations are subject to uncertainties beyond their control at both ends of the pipe. This risk puts upward pressure on pipeline costs, as do recent steel price increases. Transport infrastructure investment requires regional and site-specific knowledge of geological storage prospects, as well as knowledge of current and future CO2 source locations, volumes, and characteristics.

Regulation of risks related to pipeline transport is straightforward, but more complicated regulatory decisions will relate to funding, siting and construction of pipeline networks off-shore, onshore, and through urban zones, natural monopoly concerns, and issues of eminent domain. Different regulatory models for CO2 pipeline ownership, a privately owned, common carrier approach or a public utility approach could stimulate different

[4] International Risk Governance Council: Regulation of Carbon Capture and Storage (2008, Genova). http://www.irgc.org/Expertcontributions-and-workshop.html. P.8-15.

levels of investment, potentially influencing the ultimate organisational structure of the CCS industry.[5]

2 Co2 Transportation Methods and Needed Regulation

Captured CO2 can be transported by various means including pipeline, ship, road, tanker or railway car. The key regulatory considerations for CO2 transportation include:
-Health, safety, civil and environmental protection in the event of CO2 releases during transportation
-Allocation of liability in the event of damage resulting from CO2 releases
-Pipeline re-use, routing/corridor requirements and acquisition of rights-of-way.
-Trans boundary transport of CO2.

For all other aspects, it will be important to consider how existing regulations apply to analogous activities such as natural gas transportation. It is likely that many of the regulatory considerations described will already be covered by existing health, safety and environmental protection laws relating to such activities and/or could be conferred onto CO2 pipeline development and operation through modifications to existing laws. Operational and commercial differences between CO2 supply and transportation, and natural gas supply and transportation should also be understood so that any new regulations for CO2 transportation are appropriately adapted to the underlying characteristics. Therefore, it is vital to analyse current regulations and industry operations to assess whether they will already apply or whether they need to be modified. The main areas for consideration will include:
- Existing laws relating to occupational health and safety, in particular those industries currently using CO2 (*e.g.* industrial or oil and gas operations).
-Existing laws relating to civil protection, industrial pollution and corporate liability (*e.g.* petroleum/mining laws; major accident hazard prevention laws).
- Any development rights allowed under existing gas transportation regulations (*e.g.* the types of procedures and determinations that are already allowed, for which size of pipelines and for what types of transported fluids.
-Existing planning directives and environmental impact assessment (EIA) procedures relating to pipeline or other major infrastructure projects, including EIA requirements.
-Emissions accounting requirements (*e.g.* monitoring, reporting and verification) under emissions trading programmes or other incentives schemes if applicable
-Laws relating to the reuse of pipeline infrastructures or decommissioning (*e.g.* petroleum laws).[6]

3 EU Jurisdiction of Pipelines of Impact on the Environment

3.1 International Law Background

The pipelines transporting CO2 from the capture installation to the storage facility may cover long distances, as emitters and storage facilities often are situated far from each

[5] International Energy Agency (2010).Carbon Capture and Storage Model Regulatory Framework. http://www.iea.org/ccs/legal/model_framework.pdf P. 35-55.
[6] OECD/IEA (2010).Carbon Capture and Storage Model Regulatory Framework.

other. Whereas states have sovereignty regarding their territory and territorial waters and may apply and enforce all necessary rules and regulations in these areas, they only have sovereign rights over the continental shelf and economic zone. Following the united Nations Law of the Sea Convention of 1982 (UNCLOS 1982), these sovereign rights relate, if an EEZ has been established, to the need to explore and exploit natural resources and to the economic use of the zone relating to the production of wind or wave energy. In addition, UNCLOS 1982, in Article 87c, also explicitly provides for the freedom of the laying of pipelines.

Although neither the CCS Directive nor UNCLOS 1982 explicitly states that CO2 pipelines are to be considered to be subject to a coastal state's sovereign rights and functional jurisdiction, the wording of UNCLOS 1982 does not exclude such interpretation. If the right to regulate is not a direct consequence of the right to regulate the production and transportation of natural resources such a right may derive from the more broadly phrased right to regulate specific economic activities relating to the energy sector. state is still entitled to apply specific rules to protect the environment and national health and safety. So, whereas the states have the exclusive right to regulate the construction and use of co pipeline onshore, their legislative jurisdiction may be more limited offshore. However, they at least retain the right to regulate the protection of the environment and national health and safety.[7]

3.2 EU ETS Regulation

The EU-ETS[8] is the mechanism by which the EU may create the financial basis for CCS projects. However, the price of CO2 emissions is not expected to increase sufficiently rapidly to render CCS commercially feasible. Additional mechanisms should be put in place to support the development of CCS projects after the first wave of demonstration projects. To further increase the attractiveness of CO2 transport projects for investors, EU coverage for financial guarantees is recommended.

3.3 EIA Regulation

The CCS Directive Recital 17, article 31 requires operators to apply for an environmental impact assessment (EIA) covering the construction and operation of CO2 pipelines. The EIA shall identify, describe and assess the direct and indirect effects of a project on human beings, fauna and flora, soil, water, air, climate, landscape, material assets and cultural heritage and the interaction between these factors. These requirements must be implement in national legislations and procedures. These national requirements may go beyond the provisions in the EIA Directive[9]. It also means that the public will be involved in the process of granting permits for the construction of pipelines The EIA Directive requires that the members of the public affected by or having an interest in, the construction and use of pipelines are informed and able to participate in the decision-making process.

[7] Roggenkamp, MM.: Petroleum Pipelines in the North Sea- Principles of jurisdiction and Practical Solutions (1998). Journal of Energy and Natural Resources Law. P. 92-109.
[8] European Union Directive (2009/297/EC) to improve and extend the greenhouse gas emission allowance trading scheme of the Community.
[9] European Union Directive (85/337/EEC) on Environmental Impact Assessments.

3.4 Environmental Damages Regulation

The CCS Directive recognizes the need to protect the environment from the damage resulting from CCS. Article 34 of the CCS Directive provides for an amendment of Environmental Liability Directive (ELD) to ensure that adequate provisions are made regarding liability for damage to environments resulting from any failure of permanent containment of CO2. In principle, only the storage of CO2 is covered by the ELD under the CCS Directive, thereby guaranteeing compensation by the operator for environmental damage on the basis of regime of strict liability. However, this applies to subsoil storage of CO2 only. Transport is not included in Annex III of the ELD.

Leakages and impact on climate change

The purpose of CCS Directive is to avoid co emissions through permanent storage, any leakage of CO2 should be avoided. The CCS Directive therefore amend the EU Emissions Trading System Directive (EU ETS) to stage that stored co is not considered to have been emitted and also introduces regime of corrective measures in case of leakages. The CCS Directive brings the transport of CO2 under the EU ETS in the year 2013. Under the amended EU ETS, the operators of pipelines need to apply for an emissions permit. Article 4 of the EU ETS requires Member States to ensure that all installations listed in Annex I have permit authorising them to emit greenhouse gases.[10]

4 Cross-border transport

Based on the location of storage sites around Europe, it is concluded that that a large fraction of pipeline infrastructure will cross Member State boundaries. International cooperation will be essential to ensure that technical solutions to the managed flows of CO2 are cross-border compatible. This co-operation is also required to ensure that sufficient transport capacity is available to accommodate the increasing CO2 flows that would occur as a pipeline route traverses industrial regions on its way to a storage area. A central issue is the liability for stored CO2, which needs to be arranged between Member States. An amendment in 2007 to the 1996 London Protocol allows for the sub-sea storage of CO2 and its cross-border transport. This will provide the conditions for developing the vast storage capacity in the North Sea. However, the amendment remains to be ratified by most of the Contracting Parties and will not come into force for some time. An interim solution to this problem must be sought by Europe with some urgency.

A key issue that should be regulated before more complex CCS networks arise is the liability for transported, as well as for stored CO2. The EU Storage Directive stipulates that the storage operator will be liable for leakage over a significant period after injection. In addition, the liability is against future emission allowance prices, rendering the risk unknown and potentially large. In a one-on-one network, the financial backing for such a risk might be available. In a more complex network, with multiple suppliers

[10] European Commission, Guidance on Interpretation of Annex I of the EU ETS Directive: ec.europa.eu/clima/documentations/ets/guidance_interpretation_en.pdf. Viewed: 28/04/2012.

and more than one storage provider, as well as in international networks, the liability issue poses a threat to their development and will need to be resolved beforehand.[11]

5 Challenges and opportunities of CCS and Transportation

Safe and cost-effective transport of captured CO2 to storage sites is still essential challenge. Pipelines are in use in the USA and Turkey to transport CO2 for enhanced oil recovery and in the future these are likely to be the most viable option for transporting captured CO2 within Europe, though shipping may also have a role to play.

The energy sector usually distinguishes between several types of pipelines, like upstream, transportation and distribution. Each category of pipelines may be subject to a different set of rules applying to their construction and use. In the EU, as part of market liberalisation policy, the organisation of the use of gas pipelines has received considerable attention during the last two decades. In particular, the third party access has proven to be a central instrument in the development of a liberalised energy market. The major question is whether the qualification or distinction used in the energy sector can also be applied to co transportation systems, so that it may benefit from the lessons learned in regulating the use of energy pipelines. In case of CCS, a CO2 pipeline will connect a producer of co with a consumer or receiver of co. Considering that a pipeline is directly linked to the reservoir, it may be argued that co pipelines should be considered as some sort of reversed upstream pipeline system. Consequently these CO2 pipelines could be already governed by national laws and this would mean that the regimes applying to the use of upstream pipelines could be applied.

Additionally, the public acceptance is closely linked to the safe and environmentally friendly operations of both the transportation and storage of CO2. Unsafe transportation can result in damaged pipelines, leading to leakages that harm the environment in general. A comprehensive safety regime is in place and it can be expected that certain amendments need to be made to facilitate co transportation.

What is more, the issue of transportation of co gets more complicated if having cross-border operations. Cross-border CCS chains raise the question of the extension of states responsibility for GHG emissions, here regard to jurisdiction. Neither the UNFCC[12] nor Kyoto[13] regulated explicitly what may be called the states "spheres of emissions quotas". The general rule in international law is that states are "responsible for activities within their jurisdiction and control". This is expressed in Rio Declaration, principle 2 as well as in the preamble to the UNFCCC.

Development of a commercial CO2 transportation infrastructure will require producers of CO2 undertaking a payment commitment (e.g. a take or pay or minimum volume contract) sufficient to make a financial recovery of the investment at a reasonable rate of

[11] European Commission: Developing a European CO2 transport infrastructure (2011).
[12] The United Nations Framework Convention on Climate Change (UNFCCC or FCCC) is an international environmental treaty produced at the United Nations Conference on Environment and Development (UNCED), informally known as the Earth Summit, held in Rio de Janeiro from June 3 to 14, 1992.
[13] The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005.

return. If such a payment obligation is secured, the organisation of the ownership and operation could follow the model of an upstream petroleum or gas pipeline with the only difference that governments need to cover the political risks in the case of CO2 transport and need to ensure that the whole CCS chain is economically viable. A joint venture of owners, with or without state participation, could be formed, and an independent operator could be appointed.

Enhanced oil recovery (EOR) with CO2 can be an enabler for the development of CCS. The revenues from the additional oil produced can help finance the (early) CO2 transport infrastructure, with added benefits of additional tax revenues, stability of security of energy supply and greater competitiveness of the EU Member States. The window of opportunity for the application of CO2-EOR in the major oil fields in the North Sea requires both a rapid and early ramp-up of capture efforts and a concentration of the supply of captured CO2 towards the oil fields. Early in the development of CCS, an organised, cross-border effort is needed to fully exploit the opportunities of CO2-EOR. It is recommended to look into the feasibility of aligning CCS development and CO2-EOR options. A dedicated tax and revenue and burden sharing system could be developed, to render investments in CO2-EOR projects in the North Sea attractive. Such measures could result in kick-starting both CCS and CO2-EOR at the same time.[14]

6 Conclusions

Harmonisation of CO2 transport and storage access regimes is essential for project developers and investors considering a CCS project that requires the cross-border movement of CO2. Likewise, with the uptake of CCS, harmonized rules for CO2 infrastructure charging will create the required level playing field between different CO2 emitting industries.

The present situation of especially cross-border CCS and transportation is unclear. Neither general international law concerning principles of jurisdiction no rules on the international climate regime are fully adequate and suited as a basis for sharing responsibility between party states to a cross-border CCS chain. This problem should be considered thoroughly because of the huge potential for cross-border CCS in the future.

However, the jurisdiction criteria does not provide clear answers to all questions that are raised, especially in situations where leaks occur from pipelines or vessels. This may lead both to under-reporting of emissions and conflicts between interested parties. A more fundamental question is how the jurisdiction criteria will work as incentive for the development of trans boundary CO2 capture and storage. At the outset, it means that the state where capture takes place will have the full benefit of CCS, as its emissions are reduced. Conversely, states that have jurisdiction for transport and storage also have risk having emissions from leaks counted towards their assigned amount. In this situation,

[14] European Commission: Developing a European CO2 transport infrastructure (2011).

the transporting and storage state must and probably will seek adequate compensation from the capture state for taking the risk burden.[15]

Another problem appears if states with no emissions reduction obligations in a post-Kyoto regime take a role in cross-border CO2 chains.

Costs and financing aspects of the development of a large-scale CO2 transport network need to be resolved before larger scale CCS will be able to develop. Investments in large-scale CO2 transport infrastructure and strong tax incentives (e.g. EU-ETS) need overall European public planning, as investments are not likely to be carried out by industrial partners alone. Also, cost differences may arise between earlier and later CCS projects, so mechanisms need to be in place to prevent undue cost escalation. To prevent costs for redesigning and rebuilding to connect non-compatible infrastructure among countries, it is important to harmonise the technical solutions used across the EU as early as possible.

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Renewable Portfolio Standard (RPS) in Korea: How to Make It Work

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Abstract:

This paper explores the scope and implications of the Renewable Portfolio Standard (RPS) in Korea, and considers the ways to make the best of the regulations' potential. Combined with the trading of renewable energy certificates (RECs) issued to renewable generators, the RPS can work as an effective tool to expand renewable generation at affordable costs. After observing what has happened with the RPS in Korea so far, this paper raises the possibility that the RPS's potential will not materialize due to the design flaws in the regulation. Too ambitious target-setting, the RECs market prone to manipulation by market participants, and the multipliers' distortionary effect are pointed out as hampering the regulation's operation. Certain changes in the RPS regulation are therefore warranted, to make sure the policy objectives of securing sizeable renewable generation may be obtained at reasonable costs without too much market distortion. Employing the design analysis of the RPS regulation, as well as the statutory analysis of the relevant legal provisions, this paper proposes several changes in the RPS regulation, such as readjustment of target-setting and their strict enforcement, expansion of the buyer base in the RECs market, and reassessment of multipliers which altogether will help better serve the policy objective of expanding renewable generation at affordable costs.

Keywords:

Renewable Portfolio Standards (RPS), Korea, Renewables, Electricity, Renewable Energy Certificates (RECs)

1 Introduction

Tapping into non-fossil fuel sources for electricity generation is a requisite for any nation that is serious about implementing climate policy. Korea is not much different, considering that it has announced the target of voluntarily reducing its business-as-usual (BAU) greenhouse gas emissions by 30 percent by 2020 (Presidential Committee on Green Growth, 2012). Among the various options for Korea to successfully meet its emission reduction target will be included increasing use of renewables in power generation, as is outlined in the 5th Basic Plan for Long-Term Electricity Supply and Demand which is a governmental plan on power supply and demand detailing the policy

measures for the next 15 years (Ministry of Knowledge Economy and Korea Power Exchange, 2010).

An important question in this context is which policy tools to use in order to help increase the renewables' share in the national generation, and Korea's recent change in its choice of tools is worth a closer look. The Korean government employed feed-in tariffs (FITs) from 2002 until 2011, by which renewable electricity generators were subsidized for the differentials of the generation costs and the standard prices set by the government for each renewable source (Lee and Yoon, 2010). From this year, however, Korea has begun a set of new regulations in this field, Renewable Portfolio Standard (RPS), due to the concern that the FITs were incurring too heavy financial burden on the government without expanding renewables in a timely manner (Moon et al., 2011). Applied to the generation companies with the capacity of 500 megawatts (MW) and over, the RPS requires a certain portion of their electricity generation to come from renewable sources. Compared with the FITs, the RPS is deemed as a better tool to ensure quantity in the expansion of renewable generation, with the incurred cost to be optimized through the market competition among renewable generation companies (Lee and Park, 2008).

An observation of what took place with the RPS in Korea raises concerns, however, that the RPS's potential benefits may not materialize, mostly due to the design flaws in the regulation. As this paper duly explains later, too ambitious target-setting makes it difficult for the electricity generation companies to meet the RPS target within the suggested time frame, so that they rather take minimizing the adverse consequences of non-compliance as their second-best option, resulting in the non-accomplishment of the target. Restrictions on the participation in, as well as the trading within, the renewable energy certificates (RECs) market allow possibilities of strategic behaviour by the electricity generation companies under the RPS, hampering the smooth functioning of the market and adding difficulties to the expansion in renewable generation in the short term. In addition, multipliers, which were designed to favour certain technologies against the others to increase their market presence, drive the obligated generation companies toward big-scale renewable generation projects that take longer time to build with greater environmental impact, resulting in delays of providing the renewable electricity that will translate into non-compliance. Certain changes in the RPS regulation are therefore warranted, to make sure the policy objectives of securing sizeable renewable generation may be obtained at reasonable costs without too much market distortion.

Before answering the question of how to make the RPS in Korea work, this paper begins with the discussion on the policy tools intended to help renewables expansion, namely FITs and RPS, and compares their advantages and disadvantages. It also highlights the government's concerns on the financial burden as well as on the balance of trade payments, two unique constraints that overshadow any of Korea's policy discussions on renewables. Then this paper moves on to describing the particulars of the RPS regulation in Korea, before providing an analytical explanation of the current situation to shed light on some elements in the RPS that potentially reduce benefits for both electricity generation companies and renewable generators. This paper proposes several changes in the RPS regulation governing target-setting, market participation and multipliers, and concludes that such changes will better serve the policy purpose of increasing renewable generation at affordable costs.

2 Choice of Policy Tools on Renewables: FITs or RPS?

The objective of expanding renewables in the national generation portfolio has been tried and implemented in many other jurisdictions, and the two of the policy tools that most governments opted to employ are FITs and RPS. While they have their own advantages and disadvantages, their essential differences lie in how to bear the cost of burdens and which kind of certainty are provided for renewable generators. The following descriptions provide information on the advantages and disadvantages of each policy tool, bringing insight to the rationale behind adopting one policy tool against the other, which is exactly the Korean case.

2.1 FITs: Advantages and Disadvantages

FITs are in essence the subsidy paid by the government to renewable generators to promote their market presence, helping them with a guaranteed income even when the electricity market price goes below their power production costs (Murray, 2009). Typically this policy tool works by the government or by utilities companies paying out the differentials between the market price of electricity and the standard prices duly reflecting the generation costs of renewables, thereby giving renewable generators price guarantee and a reliable source of revenue for the duration of the FIT contracts (Davies, 2011). In fact, since the government may apply higher standard prices for renewable sources of which the generation costs are higher than those of other renewables, it can provide technology forcing for those renewable sources with cost disadvantages, making for a more balanced renewable generation portfolio (Lee and Yoon, 2010).

The biggest disadvantage of FITs is that the cost burdens on the government or utilities can become significantly large if the speed of renewable expansion becomes faster than the government's expectation, resulting in the mid- to long-term constraints in the governmental budget situation (Lee and Yoon, 2010; Presidential Council on Future and Vision, 2009). In addition, setting the standard prices right for various types of renewable is important but not always easy to do, given the market uncertainty and the information asymmetry concerning the generation costs (Lee and Park, 2008).

Considering that FITs may incur high costs for implementation, this policy tool is likely to be more suitable in countries with advanced economy – meaning deeper pockets – and with high environmental awareness on energy production. In fact, of 48 countries implementing FITs, many are located in Europe, such as Denmark, Germany and Spain (Davies, 2011).

2.2 RPS: Advantages and Disadvantages

RPS works for the same policy objective of renewable expansion as sought by FITs but with one important distinction: The financial burden for ensuring renewable expansion lies with generation companies, not the government (Lee and Park, 2008). In essence, RPS requires that generation companies provide a certain portion of their power generation from renewables, either by running renewable facilities themselves or by purchasing renewable electricity from other renewable providers. Often it is combined with some market mechanisms, named "renewable energy certificates (RECs)", allowing generation companies to purchase those renewable credits to fulfil the RPS requirement (Davies, 2011).

The advantages of RPS include the fact that it gives clear targets for electricity generation companies to accomplish, providing certainty in relation to the renewable expansion (Lee and Park, 2008). In addition, the implementation costs will likely be lower, by allowing flexibility with the trading of RECs in the market (Davies, 2011; EPA, 2009). It is noteworthy, however, that this point assumes the existence of a well-functioning certificate market, which is not always the case as the discussion in section 4 suggests. Lastly, the government's concern on the budget situation will likely be appeased, as the generation companies under the RPS bear responsibility for ensuring renewable expansion, assuming financial burdens as well, while they attempt to minimize their costs by turning to most efficient renewable generators (Lee and Park, 2008; Lee and Yoon, 2010).

Meanwhile, the lack of a price guarantee for renewable generators, as well as the possibility for generation companies under the RPS to resort to renewables with the lowest production costs, will tend to block the advances of certain renewables with great potential but with little price competitiveness (Lee and Park, 2008). Such disadvantages may be overcome with the use of multipliers for different renewable sources and with the establishment of set-asides for certain renewables, as will be discussed later, but their success will depend upon sound and well-functioning regulatory schemes.

As of 2010, 44 nations worldwide implement RPS regulations, including the United States, the United Kingdom, Australia, Italy, Sweden and Japan (Lee, 2010).

2.3 Insight on Korea's Renewable Policy

It is worth noting that Korea is still interested in growing its economy through export, given its small land size and the limited natural resource reserves. This stance is epitomized in Korea's 'low carbon, green growth' strategy, which is a name for the national climate policy but with more emphasis on exportation of Korean green technologies, nuclear included (Ministry of Government Legislation, 2010). The question of trade balance will therefore become a sensitive issue in governmental policies, including those on renewables, if such supportive policy ends up significantly increasing importation of equipment from foreign countries. Given the weak industrial base in Korean renewables (Lee and Park, 2008), this is unfortunately the case here.

In addition, most of the electricity generation sector is under the government's hand, with the government-owned generation subsidiaries having provided 435 terawatts per hour (TWh) in 2010, more than 90 percent of the electricity (KEPCO, 2011). It is also very difficult to increase electricity rates to recover increased costs for generation, due to the concern on price stability and the Korean industries' international competitiveness, evidenced by the fact that from 1982 to 2010 the electricity rates rose 19.6 percent while the consumer price index rose 208 percent (Chang, 2011). Under these circumstances the size of the payment made to support renewable generation duly becomes a concern for the Korean government, even though its policy goals is to effectively increase the renewable expansion in a timely manner.

Seen from this perspective, it is not surprising that the Korean government dumped the FITs and switched to the RPS, as a cost-saving measure, even with the list of literature suggesting FITs' superiority over RPS in terms of renewable expansion (Lee and Park, 2008; Davies, 2011). That being said, it should be all right if the Korean government went ahead with the RPS with the right set of regulations governing the related market

and the details, as the disadvantages of the RPS could be mitigated by the application of other tools, such as multipliers and set-asides. The key question to ask is, then, whether such regulation duly takes into account the current market situation in Korea or it does not foresee distortions coming from the flawed regulatory design.

3 RPS Regulation in Korea

This paper begins with touching on the transition from FITs to RPS, highlighting the FITs' strengths and weaknesses that brought the introduction of the RPS. Then it moves on to explaining the details of the RPS, discussing the renewable generation requirements for major generation companies and the RECs, which represent the electricity generated from renewables that are tradable in the market under certain conditions. These discussions help laying the groundwork for analysing the situation being unfolded under the current regulation.

3.1 Transition from FITs to RPS

First introduced in 2002 to promote the expansion of renewables (International Energy Agency, 2004), the FITs were a supportive scheme by which the government set the preferential standard prices for each renewable generation type, and pays renewable generators the differentials between those standard prices and the market prices (Yoon, 2008). Guaranteed for either 15 or 20 years from the time each facility became operative, the FITs gave renewable generators reasonably long-term price stability as well as a secure revenue flow. On the other hand, they were not the most effective tool in guaranteeing these renewable sources a fixed portion of market presence, essentially providing price certainty but not quantity certainty, as consistent with the general features of FITs (Lee and Park, 2008).

As for the risk that the payments to renewable generation would grow too fast, the government provided safety valve measures to keep that from happening. For instance, the standard prices would decrease annually to reduce incentives for excessive expansion (Lee and Park, 2008). Still, it did not prevent the glut of photovoltaic generation, with a view to taking advantage of the generous FITs for solar photovoltaic which was up to six times higher than the wholesale market price (Yoon, 2008). The solar photovoltaic capacity thus increased exponentially, from just over 200 kilowatts (kW) in 2004 to 347 megawatts (MW) in 2009 (Korea New and Renewable Energy Center, 2010). The government spending to fund FITs also skyrocketed, from 7.8 billion Korean won in 2005 to 262.6 billion Korean won in 2009 (Electric Power Public Tasks Evaluation and Planning Center, 2012), with more than 90 percent of the FIT budget directed to solar photovoltaic generation only (Kwon, 2009; Ministry of Knowledge Economy and Korea Energy Management Corporation, 2011). It did not help that the ratio of the domestic parts used in solar photovoltaic generation facilities was around 50 to 60 percent (Ahn and Chung, 2010), since more installation of solar panels would translate into more imported parts, worsening the balance of trade payments. Therefore, capacity caps were introduced in 2009 to apply to solar photovoltaic, wind power and fuel cell, paying out the FITs until the total capacity cap would be reached. The capacity cap for each of the power sources was 500 MW for solar photovoltaic, 1,000 MW for wind power, and 50 MW for fuel cell. These capacity caps would also break down to annual allocations for solar photovoltaic and fuel cell.

In the case of solar photovoltaic, annual allocations were 50 MW in 2009, 70 MW in 2010, and 80 MW in 2011, respectively. The solar photovoltaic electricity in excess of the annually allocated volume would not be subsidized by FITs but should be sold at market price, which put solar power generators at a great disadvantage.

The government eventually succeeded in limiting the costs of running FITs, but lost the program's effectiveness in expanding renewable power generation, as evidenced by the fact that the net solar photovoltaic facility installation dropped from in 257 MW in 2008 to mere 72 MW in 2009 (Choi, 2010). A change of policy tools by the government would have been inevitable, which would hopefully help regain a balance between the expansion of renewable generation and the minimization of the cost burden. Given the government's hanging concern on the cost minimization, however, the limits to how far this pursuit of renewable expansion would go were self-evident.

Under the newly introduced RPS regulation, the responsibility of providing renewable generation is transferred from the government to major generation companies with the generation capacity of 500 MW or bigger. Considering that the government-owned generation companies possess more than 80 percent of the national generation capacity (Korea Electric Power Corporation, 2011), however, the government still bears ultimate responsibility to ensure the expansion of renewable generation. Meanwhile, other considerations such as trade of balance and cost minimization should continue to play a role in guiding the government's course of action in this regard.

3.2 Details of the RPS

The following discussion of the RPS regulation is based on the relevant provisions of the presidential decree on the RPS[1] and the ministerial decree on the RPS.[2] Unless indicated otherwise, the articles appearing in the text refer to those in those ministerial decrees.

3.2.1 Renewable Generation Requirements

With the introduction of the RPS, generation companies with the generation capacity of 500 MW are obligated to produce a certain portion of their electricity generation from renewables (Presidential Decree, Article 18-3). Not all renewable sources are included for such generation requirements, however, and what are listed as acceptable by the relevant law[3] are wind, solar, tidal power, hydropower, biogas, landfill gas, biomass, fuel cell, integrated gasification combined cycle (IGCC) and waste. The national RPS targets start from 2 percent of electricity generation in 2012, which increases by 0.5 percent point until 2016, and then increasing by 1 percent point to 2022, reaching 10 percent of the national generation. Given that 1.24 percent of the national generation came from renewables in 2010, hydropower included (Korea New and Renewable Energy Center, 2011), achieving an eight-fold increase of renewable generation in over 12 years can easily become a challenge. With the Korean government unwilling to take on financial consequences of steep expansion of renewable generation under the FIT

[1] Presidential Decree on the Law on the Development, Utilization and Promotion of New and Renewable Energy, Presidential Decree No. 23640, revised and entered into force on February 28, 2012 [hereinafter Presidential Decree].
[2] Ministerial Decree on the Maintenance and Operation of the RPS, Ministry of Knowledge Economy Decree No. 2011-290, revised and entered into force on December 27, 2011 [hereinafter Ministerial Decree].
[3] Law on the Development, Utilization and Promotion of New and Renewable Energy, Law No. 10445, revised and entered into force on January 1, 2012 [hereinafter Law].

scheme in the past, one may question if such aspirational targets with the RPS regulation are realistic indeed.

A scheme of solar power generation requirements, called 'set-asides', is also put in place (Law, Article 12-5.2), which will keep increasing until 2016, to promote the domestic photovoltaic industry. These set-asides are included in the overall renewable generation targets. Table 1 shows the overall renewable generation targets as well as photovoltaic set-asides by year.

Table 1. Renewable Generation Targets and Solar Set-asides by Year

(Source: Ministry of Knowledge and Economy, 2012)

Year		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Overall Targets (%)		2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Solar Set-asides	Generation (GWh)	276	591	907	1235	1577	1577	1577	1577	1577	1577	1577
	Capacity (MW)	220	450	690	1040	1200	1200	1200	1200	1200	1200	1200

13 generation companies are currently under the renewable generation requirements, combining eight government-affiliated companies and five private ones. Their required renewable generation assignments vary in size, to take into account other factors such as their current generation portfolio. These companies are obligated to meet their assigned renewable generation targets, although they can postpone implementing up to 20 percent of their annual targets to the following year (Ministerial Decree, Article 18-3.5). To allow for more flexibility in the implementation process, the postponement of meeting their targets, which is called borrowing, is up to 30 percent of their annual targets during 2012-2014. The obligated generation companies are expected to meet their requirements either through constructing their own renewable generation facilities and producing electricity from them, or by purchasing RECs from other renewable generators (Law, Article 12-5.5).

In case the obligated generation companies fail to fulfil the renewable generation requirements, they should pay fines for up to 150 percent of the annualized average price of the RECs multiplied by their unfulfilled amount (Law, Article 12-6.1). These fines cannot be passed on to the retail electricity prices, while the recovery of implementation costs related to RPS regulations, such as investment of renewable facilities and purchase of RECs, is possible through electricity rate increases in the future (Presidential Decree, Article 18-11). Given that the retail rate increases have been difficult in the past, however, the cost recovery may not proceed as the obligated generation companies hope for, which will lead them scrambling for the least costly renewable generation available, transaction costs included.

3.2.2 Renewable Energy Certificates (RECs)

RECs are an instrument verifying that generation has been made from renewable facilities, certified and issued by the New and Renewable Energy Center, a government-affiliated organization. One REC represents the value of 1 megawatt per hour (MWh) of renewable generation.

To promote certain renewable power sources with strategic importance to the national economy, the multiplier scheme is also put in place. In essence, different multipliers are applied to different renewable sources when calculating the final value of renewable generation as RECs. Such multipliers vary from 0.25 in the case of IGCC generation to 2.0 in the case of tidal power with new embankment construction and fuel cell generation. For instance, if a renewable generator produced 1MWh of electricity using tidal power with new embankment construction, the final value of the renewable generation comes out to be 2 RECs (1MWh × 2.0 multiplier = 2 RECs). Table 2 lists the multipliers by different power source and technology.

Table 2. Multipliers by Renewable Source and Technology
(Source: Ministry of Knowledge Economy, 2012)

<table>
<tr><th>Grouping</th><th>Multiplier</th><th colspan="3">Source Type and Technology</th></tr>
<tr><td></td><td></td><td>Installation</td><td>Land Type</td><td>Capacity</td></tr>
<tr><td rowspan="4">Solar</td><td>0.7</td><td rowspan="3">New</td><td colspan="2">Rice Paddy, Dry Field, Orchard, Pasture, Forest</td></tr>
<tr><td>1.0</td><td rowspan="2">Others</td><td>Over 30kW</td></tr>
<tr><td>1.2</td><td>Under 30kW</td></tr>
<tr><td>1.5</td><td colspan="3">Over Existing Buildings and Facilities</td></tr>
<tr><td rowspan="5">Other Renewables</td><td>0.25</td><td colspan="3">IGCC</td></tr>
<tr><td>0.5</td><td colspan="3">Waste, Landfill Gas</td></tr>
<tr><td>1.0</td><td colspan="3">Hydropower, Onshore Wind Farms, Biogas, Biomass, Tidal Power (without new embankment construction)</td></tr>
<tr><td>1.5</td><td colspan="3">Small-scale Offshore Wind Farms</td></tr>
<tr><td>2.0</td><td colspan="3">Large-scale Offshore Wind Farms, Tidal Power (new embankment construction), Fuel Cell</td></tr>
</table>

RECs are valid for three years after the date of issuance (Law, Article 12-7.4), for which time they are tradable in the spot market run by the New and Renewable Energy Center once a month, although the buyers of such RECs are limited to the 13 obligated generation companies. The RECs that those 13 companies generate using their own renewable facilities are excluded from trading, but they count towards meeting their renewable generation requirements. Under a degree related to the RECs,[4] trading of RECs is one-time only (Center Decree, Article 34), meaning that no secondary market will be allowed. To reflect their generation cost differentials, solar-based RECs are traded separately from other renewable-based RECs.

It is also possible for the obligated generation companies to enter into long-term contracts with renewable generators and earn RECs as a result (Center Decree, Article 30.1). In the case of solar-based RECs, the New and Renewable Energy Center may

[4] Center Decree on the Issuance of RECs and the Operation of the REC Market, New and Renewable Center Decree No.2012-11, revised and entered into force on May 22, 2012 [hereinafter Center Decree].

help find those renewable generators, by running an auction twice a year based on the renewable generators' bid price to meet the obligated generation companies' demand of RECs. Another special provision for solar photovoltaic generation is that generation companies with the generation capacity of 5 gigawatts (GW) should purchase at least 50 percent of the solar-based RECs they need to meet the set-asides requirement (Ministerial Decree, Article 10.1). Six government-owned generation companies are under such a requirement.

4 Assessment of the RPS: Doomed?

Only six months have passed since the RPS was introduced, and therefore it will be too early to tell whether the RPS is going forward successfully or doomed to failure. There are ominous signs on the horizon, however, that the regulation in its current form is not conducive to achieving the policy objective, which is to expand renewable generation at affordable cost. This section explains what has been going wrong with the RPS, and critiques some elements in the regulations that hamper the effective functioning of the RPS and the REC transactions.

4.1 Too Ambitious Target-Setting

In general the RPS targets would better be set high to encourage renewable generators and to reduce uncertainty for their businesses (Lee and Park, 2008). Considering that the renewable generation in 2010 was a mere 1.24 percent of the national total generation, increasing the renewables' share to 10 percent in over twelve years will be a tall order in any case. If the generation outlook for 2022, 598.9 TWh (Ministry of Knowledge Economy and Korea Power Exchange, 2010), serves as a reference point, the required generation from renewables should reach at 59.8 TWh, almost a ten-fold increase from the renewable generation of 5.88 TWh in 2010. An added concern is that Korea does not abound in renewable generation potential, maxing at 815.7 TWh with all technologically available sources (Ministry of Knowledge Economy and Korea Energy Management Corporation, 2011), less than twice the electricity generation in 2010 at 474.6 TWh (Korea Electric Power Company, 2011). If the economic factor, i.e., cost factor, is taken into account, the economically available renewable generation sources would shrink further.

Under such unfavourable circumstances, mostly aspirational targets would end up short of achieving the stated goals. The obligated generation companies already opine in public about failing to meet the targets and about being subject to fines as a result, notwithstanding their best efforts to expand their own renewable generation and to purchase RECs from the market, as there are simply not going to be enough RECs available (Yoo, 2012). Furthermore, this failure to meet the RPS targets may lead to the obligated generation companies' strategic behaviour to guard against the worst consequences for their non-compliance as the second-best option, which will be discussed in the next subsection.

In sum, with all its good intention, this ambitious target-setting opens a door to the 'salience distortion', 'the facial representation of an aggressive goal that, in fact, is not aggressive at all' (Davies, 2011).

4.2 REC Market Prone to Manipulation

The REC markets are composed of two elements, which are for solar photovoltaic only and for the other renewable power sources. In the case of other renewable REC spot markets, the bidding processes have been smooth in the past four months, and the market prices for RECs duly represent the fair value of the renewable generation. However, the solar photovoltaic REC market is showing signs of turbulence, as shown in the last bidding process for solar power contracts and spots where the obligated generation companies limited their REC demand to such a small number that drove down the price for the solar photovoltaic RECs by 30 percent (Jeong 2012). Table 3 illustrates the details of solar and non-solar REC transactions in the past four months.

Table 3. Solar and Non-solar REC Transactions in the Spot Market by Month (2012)
(Source: Jeong, 2012; Kim, 2012)

	Mon/Year	Feb/2012	Mar/2012	Apr/2012	May/2012
Solar RECs	Quantity (RECs)	18	44	553	4
	Price (Korean won)	229,400	220,000	219,862	161,000
Non-Solar RECs	Quantity (RECS)	1,031	-	1,254	4,215
	Price (Korean Won)	42,400	-	48,193	52,251

As the solar photovoltaic market is currently suffering from oversupply of solar panels (Han, 2012), the market for providing solar power electricity has become a buyer's market. Depending upon the buyers' strategic moves the price could drop further, benefitting the obligated generation companies at the expense of solar photovoltaic generators. Considering that the obligated generation companies could put off complying with their annual targets for up to 30 percent in the first three years of the RPS regulation, they may find it beneficial to purposefully hoard their renewable power demand in early years, driving down the REC prices for solar photovoltaic and profit from the purchase of cheap RECs of which the value is suppressed due to market manipulation. Since the prices of RECs are also relevant in calculating fines for non-compliance, these obligated generation companies have further incentives to keep the REC prices down. These suppressed REC prices will act to drive many solar photovoltaic generators out of the market, resulting in the devastation of the supply base if this phenomenon continues for a long time, which may make it difficult for the solar set-asides to be met and hurt the generation companies as well.

It would be too early to conclude the obligated generation companies' moves as manipulative, as they may indeed have had other reasons to demand less RECs in that specific month. The transaction records for solar RECs suggest, however, that the possibility of market manipulation due to the market participants' strategic behaviour is sufficiently real, and may even increase in extent given the market dominance the obligated generation companies currently enjoy.

4.3 Distortion through Multipliers

Multipliers are intended to provide support for renewable projects that are economically disadvantaged to build and operate, by increasing the number of RECs that are issued

from those renewable generation projects (Ministry of Knowledge Economy, 2012). However, the differentials of multipliers being applied to various renewables appear to favour big-scale facilities that take long to construct, whereas their overall environmental values are somewhat questioned. For instance, the highest value of 2.0 is given to such large-scale projects as off-shore wind farms and tidal generation with newly constructed embankment. Drawn by its high multipliers and low construction costs, some obligated generation companies rushed towards tidal generation (Lee, 2012), expecting an early take-off. Instead, because of the anticipated significant impact on the adjacent environment, such big projects are being held up by lawsuits and by local residents' protests (Thacker, 2011), which will not help serving the policy goal of securing renewable generation expansion in a timely manner, the very reason that the government chose to introduce the RPS instead of the FITs.

5 Suggestion for a Better RPS

While the policy goal of expanding renewable generation is in itself admirable, the means of implementing the RPS regulation are under serious doubt, raising concerns that the regulation may not show its full potential due to the combination of several design flaws. With the irregularities shown six months into the implementation, the RPS regulation warrants careful reconsideration of some of the policy elements to make the whole scheme work better. The below are some suggestions to address those irregularities, with a view to guaranteeing continuous success of the RPS regulations as a policy tool to achieve renewable generation expansion at affordable costs.

5.1 Adjustment of Targets with Strict Enforcement

Even though the government decided to switch from the FITs to the RPS to alleviate its concern on the financial burden of supporting renewables, the stated policy goal of renewable expansion ought to be sought to the utmost extent possible. Under the circumstances where the obligated generation companies openly discuss possibilities of not meeting the RPS targets and worry about paying fines as a consequence, however, the ambitious target-setting through 2022 will not make sense, as it is simply counterfactual. Renewable targets that are based on realistic assessment of renewable generation potential, combined with regulatory certainty in ensuring the attainment of policy objectives, will be a better fit in the new regulatory environment. This paper therefore suggests scaling down on the yearly renewable targets by 20 percent, with the year 2022 target reset at 8 percent. This number is more in line with the 5th Basic Plan for Long-term Electricity Supply and Demand, which projects generation from renewables in 2024 at 7.9 percent of the total national generation (Ministry of Knowledge Economy and Korea Power Exchange, 2010). While the end result of such adjusted targets may well be short of the originally stated goal for fast renewable expansion, here the real choice should rather be made for modest and realistic targets, over aspirational targets that will surely not be met.

In combination with the readjustment of renewable targets, measures to solidify them will also need to be taken, to minimize the room for the obligated generation companies to attempt non-compliance with the regulation. One of the measures conceivable is the abolition of the borrowing provision, at least from 2015, the end of the first three years since the introduction of the RPS. As the relevant provision may provide the obligated

generation companies with excuses for not being serious in meeting their annual targets, rather than helping them with flexibility in compliance, it may be removed once the unrealistic targets are readjusted.

5.2 Expanding Buyer Base in the RECs Market

Due to the ambitious renewable target-setting, in theory the RECs market should be characterized as a seller's market, implying the expected shortage of supply in RECs and the upward tendency of such certificates' prices in the market over time. However, as there are only 13 generation companies that can act as purchasers of RECs, the market power that they can wield to press down on the REC prices will be significant. The recent records on the solar photovoltaic REC prices gives credence to the concern that the RPS's policy objective may be frustrated without enough demand for RECs. Without rigorous monitoring of the market behaviour, it is even possible that obligated generation companies will behave strategically to put downward pressure on the REC prices.

As an alternative, it would be advisable to expand the buyer base to include other non-utilities with expertise in providing renewable generation in the best economic fashion, such as energy brokers and other intermediaries. It essentially means allowing the introduction of a secondary market for RECs, such as is possible in the United States (Chumak, 2008), by letting purchasers and sellers freely decide on the price and quantity of RECs being traded. For this possibility to become materialize, certain provisions restricting the trading of RECs acquired at the market, such as limiting the number of times the RECs can be traded, would better be removed. In addition, the participation of the government in the RECs market may help stabilize the prices of RECs, by acting as a buyer of RECs when the demand of RECs is too weak in a certain auctioning day and also by acting as a provider of RECs when the demand of RECs is far stronger than usual. The government is reported to have shown interest in participating in the RECs market as a RECs supplier (Energy Korea, 2012), but the government could also help the RECs market mature by acting as a buyer of RECs, for use when the market destabilizes in the future.

5.3 Reassessment of Multipliers

As mentioned earlier, the manner in which multipliers were set for each renewable generation method had the effect of favouring large-scale renewable projects such as tidal generation and offshore wind farms, weakening the potential of some promising renewable technologies. Even if the RPS regulations still has as a policy objective promoting renewable industries, and while one of the rationales behind the multipliers is providing incentives for some renewable technologies that are not yet the most economical and are difficult to tap, there must be a balance between environmental and industrial policy perspectives, not favouring technologies with potentially destructive effects on the neighboring environment. At least the multiplier of 2.0 given to large-scale offshore wind farms, tidal power generation with new construction of embankments, should be reduced to 1.5, the same value given to smaller-scale offshore wind farms. This type of readjustments will also help the obligated generation companies look for other renewable options with more potential for timely provision and less social friction.

The government is also not insistent on sticking with the current values of multipliers, as these multipliers are subject to periodic reviews every three years (Ministerial Decree, Article 7; Ministry of Knowledge Economy, 2012). When such periodic reviews are made, a more emphasis should be placed on the environmental integrity of renewable generation methods, rather than on the promotion of certain renewable generation technologies for industrial policy purposes.

6 Conclusion

In addition to energy independence, expanding renewable generation has other positive effects, including less greenhouse gas emissions by relying less on fossil fuels, and environmental benefits coming from less-polluting generation technologies. The search for a cost-effective means to achieve such a policy objective brought about the introduction of the RPS regulation in Korea, but the regulatory scheme in its present form is potentially frustrating the stated policy goal due to the flawed regulatory design. This paper is an effort to redress such defect by reassessing and redesigning some of the elements in the RPS regulation, so that the RPS's main objective of expanding renewable generation at affordable costs can be accomplished. If the RPS's incentive structure is rearranged along the lines of this paper's suggestions, Korea will hopefully see a steady growth of renewable generation in the next decade, promising herself to become one of the leading nations in terms of renewable generation as well as the policy designs related to the RPS.

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The Impact of Interventions on Projects: a Case Study of Public Interest Litigation

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Abstract:
Successful project management is traditionally based on the eternal triangular relationship of cost, time and quality. The control mechanisms and management techniques are therefore based on these criteria. Legal interventions are not normally anticipated in disrupting the planning or the progress of projects. Now that there are new expectations from global development, climate change and environmental impact, issues of public interest has become one form of project risks that their interventions can be so diversified that they require different management techniques. Interventions hereby refer to intervening events arising from the law of public interest in disrupting project planning or project progress. Public interest litigation and the principles are discussed. A case of judicial review of an infrastructure project is selected for detail analyses to reveal the root causes for legal actions and the associated impacts on time and cost in disrupting the projects. The findings are intended to provide a scenario of the impacts of legal interventions on the projects. It is expected that the case would provide implications of the public law to inform how to reduce the impact of the intervening event.

Keywords:
case study, interventions, judicial review, public interest litigation

1 Introduction

Judicial review (JR) has recently been popular not only for applying to the usual human rights and immigration matters, but also to environmental law and policy matters affecting projects. It is nowadays used as a 'legal step' by the stakeholder to acquire their civic right in the legal administrative system on issues of public interest. Since there are new expectations in the society coming from global development, climate change and environmental impact, construction projects may be disrupted by intervening events relating to public interest and bring time and cost consequences. Presently there is no one form of management technique appropriate for handling such project interventions. An infrastructure project, which has been undergone court proceedings for application and for appeal, with ample public interest and attention, is examined to inform how to reduce or to accommodate the impact of the interventions.

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2 Public Interest Litigation

Public interest litigation (PIL) means to protect a general interest that is larger than that of individual case interest. It is common that the applicant would seek legal aid to pursue the social and economic rights of a largely urban and consumer society such as for the economic well-being of an emerging middle class (Fu & Cullen, 2011). There are incentives for public interest litigation as the judicial process is well structured with a degree of predictability, transparency and publicity; and for this reason, there is a higher expectation of fair play in the judicial process in comparing to other political and administrative process (Fu & Cullen, 2011). Thus, public interest in law concerns its bearing in justice whereas public interest litigation tends to be a process for debating social justice.

Judicial review is a form of court proceeding in which a judge reviews the lawfulness of a decision or action made by a public body. It is based on an allegation that the public body has taken an unlawful decision or action while there is no adequate alternative remedy. The key issue of a judicial review is whether the correct legal basis has been used in reaching a decision, and not about whether the decision is 'right' or 'correct'. [1] Public law project research is now regarded as an important part in government policy formation and legal reform.

In the constitutional law of the UK, JR is a control by courts over certain decisions taken by administrative and other decision-making bodies of the government, usually the parliament (Olley, 2003). The applied rules is that derived from the case Associated Provincial Picture Houses v. Wed-nesbury Corporation [1948] 1 KB 223. The 'Wednesbury' principle derived from the case is that the courts may interfere where the decision that has been taken is one that no reasonable body could have reached *(*Stewart & Burgess, 2001). The basis for making decision in a JR can be referred as:

'one can conveniently classify under three heads the grounds upon which administrative action is subject to control by judicial review. The first could I would call illegality, the second irrationality, and the third procedural impropriety'.[2]

The question on JR is raised because it has been queried that the courts are applying the intent of the legislature. When case law is applied, the court decision in a JR case would become a legal reference for future case. With JR being a central principle of the administrative law, a JR case then becomes a foundation for legislation. The difference can then be seen between the civic system and the common law system as to how "law" is made and how policy is established.

The *ultra vires* principle is based on the assumption that judicial review is legitimated on the ground that the courts are applying the intent of the legislature. This is vital to the developed law of JR. In the English law, JR is about the doctrine of ultra vires, the

[1] The Public Law Project Information leaflet 2, 2006)
http://www.publiclawproject.org.uk/downloads/WhatIsJR.pdf
[2] Council of Civil Service Unions v. Minister for the Civil Service [1985] AC 374.

central principle of administrative law (Craig, 1998). However, there is a different perception of JR. Yap & Lau (2011) relates PIL to public wrongs and refers Judicial Review (JR) as a litigation process to challenge and correct public wrongs committed by governmental bodies. The UK rule of law relates it to the law of public interest, whereas Hong Kong, generally based on the old English rule of law, refers JR as a court proceeding to clarify the scope of court jurisdiction as well as the relationship between the government bodies, the rule of law and the constitution (Olley, 2003; Lui, 2007). Yap (2011) distinguishes Public interest litigation (PIL) with two types of wrongs, generalized grievances and specific grievances. The first bears common interest of the society whereas the second bears only a segment of society directly suffers the wrong. The threshold stage of PIL is to seek leave for JR. The considerations of PIL are based upon whether the issue is of public importance, whether the applicant has the right to seek JR, and whether the applicant has a genuine interest in the vindication of the alleged wrong, and it is important to make clear that the case is not private interest litigation (Yap, 2011). However, the doctrine of *ultra vires* is not without problem. It imposes frictional intention and is incomplete and fails to explain JR's jurisdiction over non-statutory bodies; and in Hong Kong, the friction is created between the legal system and the Basic Law (Lui, 2007).

According to the Public Law in UK, if the application is successful, the court has the option for "quashing orders", "prohibiting orders", "mandatory orders", "a declaration", "an injunction", or "damages". According to the law in Hong Kong which is also based on common law, the relief to be sought from a judicial review can be "Mandamus", "certiorari" (quashing orders), "prohibition", "declaration", "injunction", "damages", or "interim relief" . "Mandamus" is an order compelling the respondent to perform an act specified in the order of the court, which is the nature of a public duty or obligation, but such act or obligation must be specified in the application, while "certiorari" means quashing order. The term follows the old English rules (Olley, 2003). "Interim relief" refers to the possibility of an interim order before the application for judicial review is decided. It can be seen that this additional administrative procedure is provided in the system in Hong Kong to help saving resources before reaching a decision.

3 The Project Case

The HZMB (Hongkong-Zhuhai-Macao Bridge) **Case:** In this case, the challenge was put forward by one local resident for judicial review in the Court of First Instance to the Environment Protection Department in approving the Environmental Impact Assessment Report and subsequently issuing the environmental permit for the HZMB project.

The significance of the case cannot be understood without mentioning the nature of the project. The Hongkong-Zhuhai-Macao Bridge (HZMB) connects three locations in the Pearl Delta region, Hong Kong Lantau Island, Guangdong Zhuhai and Macao, and is a mega-sized infrastructure project involving cross-border facilities linking sea and land routes. The HZMB project involves a 29.6 km dual 3–lane carriageway in the form of bridge-cum-tunnel structure. The Main Bridge runs from an artificial island off Gongbei of Zhuhai to an artificial island west of Hong Kong. The construction of the overall facilities is estimated to be over 70 billion Hong Kong Dollars (or US$8.97 billion). The

HZMB project is complex in nature and difficult to build in terms of the technical methods adopted for construction and engineering works. It involves planning aspects like site locations and alignments affecting the use of land, environmental aspects such as from changes in sea currents affecting the life of Chinese White Dolphins to air quality affecting nearby sites and the neighbouring residents. The project constitutes a group of work sections to be let separately. Nine work sections constituting preliminary design, detailed design, site supervision, quality management type of consultancy contracts together with the construction contract of the tunnel and artificial islands have already been let (May, 2012), and the other work sections are in the tendering channel including the construction of the Main Bridge.

The idea of constructing the bridge was firstly initiated by an infrastructure/engineering developer cum contractor in 1983. The planning of the bridge started in 2003 after the Hongkong-Zhuhai-Macao Bridge Advance Work Coordination Group was established. Pre-construction works was started in 2009, and the construction of the HZMB commenced in 2010 and has been expected to be completed in 2016. For a project to be constructed on new land is without doubt highly uncertain and complex. The site locations and road/bridge alignment have been changed since their initial planning in 2005. With the increased awareness of constructed facilities on the environment and in particular the pollution aspect, quality of air has aroused public interest. Even though HZMB has opened to public consultation and engagement, a juridical review of the case is called and caused surprise to many stakeholders involved in the projects.

4 The Intervention Case[3]

The construction of HZMB started in 2010 was suspended by a legal intervention relating to environmental law in early 2011 at a time when the dredging project of the artificial island was 90% completed. The intervention was triggered off by an elderly lady Ms Chu who claimed that she had diabetes and heart disease and lived close to an air sensitive receiving areas near the HZMB project. Ms Chu applied for a judicial review for the validity of the environmental impact assessment (EIA) report prepared in October 2009. Two issues were brought to the attention of the High Court:

- whether the Director of Environmental Protection Department has properly discharged her statutory duties and functions under the Environmental Impact Assessment Ordinance, Cap. 499 ("the EIAO"), in respect of part of the works forming the proposed HZMB project.
- whether the air quality impact of two of the projects connected with the HZMB was properly assessed in the environmental impact assessment reports for those projects.

In complying with EIAO, the project proponent needs to apply to the Director for an EIA study brief (s.5(1)a of the EIAO) based on the guidelines laid down in Section 3 of the Technical Memorandum. Once the study brief is issued by the Director, the project

[3] Chu Yee Wah v Director of Environmental Protection, HCAL 9 of 2010
http://www.epd.gov.hk/eia/english/content/files/HCAL_9_2010.pdf

proponent is to prepare the EIA report (s.6(1) of the EIAO). The environmental impact assessment report was approved in Oct 2009 and the environmental permit was issued the next month. There are seven issues applied for judicial review:

Issue 1	Absence of quantitative 'stand-alone' analysis
Issue 2	Lack of presentation of input data in PATH model
Issue 3	2031 as reasonably worst-case scenario
Issues 4 & 5	Failure to assess ozone and SO_2
Issues 6 & 7	Public health impact

5 Legislation relating to Environmental Law

Environmental law in action in Hong Kong comprises law and regulations including environmental legislation, compliance guides, environmental standards and compliance. Environmental Impact Assessment Ordinance (EIAO) was implemented on April 1998. Its purpose is to avoid, minimise and control the adverse impact of the environment of designated projects, through the application of the environmental impact assessment (EIA) process and the environmental permit systems (EPD, 2009). The legislation is administered via EIA (Appeal Board) Regulation, EIA (Fees) Regulation and EIAO (Amendment of Schedule 2) Order 1999 to provide environmental law and regulations for public interest of the built environment.

The "designated projects" requiring environmental permits are stated in the Schedule 2 of the EIAO and these include roads, railways and depots; airports and port facilities, reclamation and miscellaneous such as projects including new access roads, railways, sewers, sewage treatment facilities, earthworks, dredging works and other building works partly or wholly in an existing or gazetted proposed country park or special area, a conservation area, an existing or gazetted proposed marine park or marine reserve, a site of cultural heritage, and a site of special scientific interest. Thus an infrastructure project is required to provide environmental impact assessment report and an environmental permit before construction work is commenced.

5.1 The Documentary Reference

The project applicant seeking for an environmental permit shall prepare an environmental impact assessment report according to Environmental Law Cap.499 Section 6(1) with the following requirements:

(a) the environmental impact assessment study brief; and
(b) the technical memorandum applicable to the assessment

Thus the technical memorandum and the study brief are important documentary reference for the application. According to Environmental Law Cap.499 Section 16 (1), the technical memorandums are to set out principles, procedures, guidelines, requirements and criteria for:

(a) the technical content of a project profile;
(b) the technical content of an environmental impact assessment study brief or

environmental impact assessment report;
(c) deciding whether a designated project is environmentally acceptable;
(d) deciding whether an environmental impact assessment report meets the requirements of the environmental impact assessment study brief;
(e) deciding whether the Director will permit an applicant to apply directly for an environmental permit under section 5(9), (10) or (11);
(f) resolving conflicts on the content of the environmental impact assessment study brief and the environmental impact assessment report;
(g) taking advice from other authorities;
(h) deciding what is a material change, addition or alteration to an environmental impact or to a designated project;
(i) the issue of environmental permits;
(j) the imposition of environmental monitoring and audit requirements for designated projects as conditions in environmental permits.

5.2 Impact on the Environment

The project proponent had to do three things: describe the possible impact of the project on the environment, consider the major elements of the surrounding environment, and propose measures to minimise environmental impact on the possible severity, distribution and duration of environmental effects. Therefore, the proponent has to outline the processes and information involving emissions and discharges, and describe the environmental impacts or issues that may arise during the construction, operation or decommissioning of the project.

What constitute ambiguity are the measures to minimise environmental impact on the possible severity, distribution and duration of environmental effects in respect of the beneficial and adverse effects, the short and long term effects, the secondary and induced effects, the cumulative effects and the trans-boundary effects whenever applicable; but these requirements or measures are still undergoing development and will change at times between application and implementation as it is not unusual that planning (when application is made) is carried out several years before the actual implementation. While there may not be similar projects to refer, or the focus of public interest and political sensitivity change, it is difficult to predict other implications at the time of submitting project proposal and EIA applications. In other words, there is an administrative gap, which is also a time gap for understanding the environmental impact.

5.3 Evaluating the environmental impact for the designed projects

For the evaluation of the environmental impact, it is clearly not a case questioning procedural justice according to the detailed administrative procedure in the system, but rather to what extent that EIA should be carried out to mean ‘sufficiency’. In a detailed analysis of the process, it was noted that the end product was assessed but not the process creating the product, meaning that the construction was not assessed on the impact of ozone, sulphur dioxide and suspended particles, which was considered in the JR case unreasonable and illegal according to the environmental protection law.

This judicial review did not concern matters of procedural fairness or the lawful discretion of the Director. The Technical Memorandum and the Study Brief was not the subject of challenge in this judicial review. These documents were therefore not construed as legislative instruments. Thus the decision was made upon whether the requirements are met, and the JR case was directed to the Environmental Permit issued by the Director of the Environmental Protection Department.

6 Key Issues of the Intervention

Two key issues on public interest are raised in the case. The first is the public interest in the protection of the environment upon which the quality of life in Hong Kong will depend. The second is the public interest in ensuring that major designated projects are brought to fruition in a timely and efficient manner. The subject in debate is mainly grounded on the first issue, whereas the second issue is to be covered by a revised budget to be approved by the Financial Committee.

6.1 The result

In March 2011, Hong Kong High Court held the judicial review and declared the EIA reports invalid and requested that the Director of Environmental Protection Department to revoke the environmental permit. The ruling was that there was no separate assessment on the air, and therefore did not meet the requirements of the research outline and technical memorandum. The contention is that if the report did not meet the requirements, the director should reject it. The claimant representative claimed that:

> "the government should not abandon the effective supervision like protecting the ecology and public interests through environmental assessment for the economic growth and regional integration."[3]

6.2 Judgment made[3]

[4]The judgment made for the case is that the applicant's contention on Issue 1 is accepted whereas the contentions on Issues 2 to 7 are rejected. This is because there is an absence of a stand-alone analysis in the EIA Reports in complying with the Technical Memorandum and the Study Briefs. It follows that the Director had no power to approve the reports and to grant the environmental permits for the two projects in question. The court makes clear that this is not a judgment on the merits of the projects nor on the question of whether, despite any adverse environmental impact caused by those projects, but on the issue whether the adverse environmental impact of the projects are properly assessed and presented in compliant environmental impact assessment reports. Although the Judgment made in accordance with Issue No. 1 was allowed, however, the standard of requirement was arbitrary.

The judgment made was upon an argument that the government only provided the data of the impact of the project but not the data without the project. The government put the case to appeal. In September 2011, the Court of Appeal approved the draft outline zoning plan and the authorized reclamation works, and allows for the Director of

[3] Chu Yee Wah v Director of Environmental Protection, HCAL 9 of 2010
http://www.epd.gov.hk/eia/english/content/files/HCAL_9_2010.pdf

Environmental Protection Department's appeal. The EIA report and permits therefore maintain valid. The Financial Committee subsequently approved the revised budget for the construction of the HZMB in Nov. 2011, and the construction of HZMB restarted in Dec. 2011.

6.3 The appeal[5]

It was stated at the judgment made at the appeal that "It is not for the court to decide matters of policy" and that the environmental standards should be established under the ordinance. The judgment is based on two arguments in quashing order. Firstly, the project case comprises a series of projects and in this case three projects are related to the cross-boundary facilities, the bridge and two link roads. The argument is stand-alone analysis of each project or the cumulative effect of the project case. Secondly, the standard setting out the environmental requirement for the environmental impact assessment report is based on the technical memorandum and the study briefs. There is no mentioning of the requirement of a stand-alone analysis but the cumulative effect. The technical memorandum is taken as general requirement whereas the study briefs are taken as project-specific. Since the report is approved on 23 Oct. 1999, the standard requirement would be as the time of approval and not as any new standard prevailing at the time of application of JR in April 2011.

The criteria for evaluating air quality impact and hazard to life together with the guidelines for air quality assessment are included in the Annex document of the Technical Memorandum. While the detailed requirement accounting for the cumulative impact form the construction and operation of existing and planned/committed projects in the vicinity of the Project has been dealt with. Even for the phased implementation of the Project and the associated works. According to the judgment on the case, it is decided that the case is to base on the existing AQOs which represent the minimum standard of acceptable air quality or the "lowest common denominator", even though the Government's Air Quality Objectives Review means to enhance the air quality standard and impose more stringent AQOs, the court will not decide on matters of policy, whereas the judge stated that "It is not for the court to decide matters of policy" and that the environmental standards should be established under the ordinance.

7 Time and Cost Consequences of the Intervening Event

The construction was started on December 15th, 2009. The judicial review was initiated in late 2010. The construction works was then suspended and there had been a concern of the project cost increase. The increase of the project cost by 5% is estimated at the time of the intervention, and the cost could multiply if the applicant succeeded. This was because there were more than seventy projects on hold due to the legal interventions to the HZMB project. These similar projects would also require environmental assessment permits before commencing the works. There was no knowledge of the effect of cost and time consequences of these other projects.

[5] Chu Yee Wah v Director of Environmental Protection, CACV 84/ 2011

It had been suggested in Legislative Council to the government to hold a bid in advance and award contracts to the areas to construct in phases to catch up with the inland construction to minimise the impact of the suspension.

The increased cost was estimated to be 6.5 billion HKD (noted in Table 1), and can be referred as a time cost because it was targeted at accelerating the works to a compressed schedule such that the project can be completed on time in 2016. The cost covered increased labour resources, arrangement of overtime work and increased plant resources together with the increase in construction prices. Approximately half of the increased cost was contributed by labour, materials and plants, and approximately half of the increased cost was derived from the high tender price coming from the higher-than-expected risk assessment by tenderers together with the increased cost for construction resources and changed market conditions (see Table 2). The cost increase was therefore a result of the increased tendering prices and changes in construction methods.

The judgment of the JR was made on 18 April 2011, and the judgment of the appeal was made on 27 September, 2011. The construction of HZMB was suspended in April 2011 due to the intervening event and restarted in Dec. 2011. There was a delay of 8 months. The relevant tenders were called after 9 months and the tenderers became cautious and submitted tender prices higher than expected. The explanation given was that the target risk was high in addition to the adjustment of market price due to the time delay. The increased cost was adjusted to accommodate the inflation, the increased cost, the acceleration cost and the changed market conditions for the time schedule already planned for. With the time value adjustment, the increased cost for the construction of HZMB was 8.86 billion HKD (see Table 1), and the revised budget was approved by the legislative council in May 2012.

Table 1 Estimated cost for an eight year expenditure for the construction of HZMB at different times

Timeframe	Estimated total (pricing)	Estimated total (MOD)	Increase
Nov 2011	13,574.4 (Sept 2010)	16,189.9	2,615.5
May 2012	20,950.4	25,047.2	8,857.3

Table 2 Items of cost increase to HZMB due to the intervention

Item of increase	HK Dollars (million in MOD)	US$m equivalent
Price increase for time delay	3,270	419
Tender price increase	3,440	441
Increase in contingencies	670	86
Increase in price adjustment	1,480	190
Total	8,860	1,136

8 Analysis and Discussion of the Case

In the HZMB case, it is not about whether the case is lawful or unlawful, nor the decision is irrational, unfair or biased, but rather that the decision is comprehensive enough to take care of the interest of neighbouring residents if the project does not exist. What constitute ambiguity are the measures to minimise environmental impact on the possible severity, distribution and duration of environmental effects in respect of the beneficial and adverse effects, the short and long term effects, the secondary and

induced effects, the cumulative effects and the transboundary effects whenever applicable; but these requirements or measures are still undergoing development and will change at times between application and implementation, as it is not unusual that planning (when application is made) is carried out several years before the actual implementation. While there may not be similar projects to refer, or the focus of public interest and political sensitivity change, it is difficult to predict other implications at the time of submitting project proposal and EIA applications. In other words, there is an administrative gap, which is also a time gap for understanding the environmental impact.

For the HZMB project, the JR event and the increase in costs caught a lot of public attention. Based on Down's Issue-Attention Cycle (1972), there is a gradual realization from the "public" that the cost of "solving" the problem is very high. The "solution" may be viewed as a financial sacrifice to groups of people in the society, and benefits to others in fulfilling a fundamental goal of public interest. After the stage of "Realizing the cost of significant progress" (Down, 1972), the HZMB project is reinstated after the revised budget is approved. In the approval process of the Financial Committee, a large amount of paperwork and supporting documents had been produced with a view that there would not be any more 'unanticipated' event in affecting the economic efficiency of the project. There is then a gradual decline in the intensity of public interest in the problem, and people tend to have a mixed feeling about the intervening event and come to realize how costly to have a solution to the problem.

The implication of the judgment for the case of a project nature is that two issues are to be addressed in the administrative law. First, there should be a system of priority setting for significant "designated projects". Second, there should be a separate case management system to monitor intervening events. In the UK, it has been suggested to have mediation or other alternative dispute resolution methods to take over JR, but this suggestion is generally based on cases of social nature. When JR is applied to infrastructure projects, a special group should be assigned, or perhaps initiated to be formed when there is a need, to speed up the process and to support the court, to make rational, unbiased and fair decision. For the general principle of JR, the judgment of the case has adopted Wednesbury principle to rebut irrationality and unreasonableness for the issues about the documentary references and the air quality standards. Together with the doctrine of Ultra Vires, a reasonable judgment is made and the multiply time and cost effects of the environmental impact on a series of projects have been avoided. It is fortunate that the subject is not further complicated with the Basic Law which has been derived from a different legal system.

9 Conclusion

In the HZMB case, it is not about whether the case is lawful or unlawful, nor the decision is irrational, unfair or biased, but rather that the decision is comprehensive enough to take care of the interest of neighbouring residents if the project does not exist. It is a question of the time gap or the administration gap of the standard requirement, in the case, the air quality or the environmental standard, which can be resolved in the administration or the administrative law. It should however be noted that setting up proper systems is not sufficient as it may not catch up with the technology development

at the time. While JR is considered to be well-structured, transparent, with full publicity and a degree of predictability, debating social justice is an open system external to any projects that are complex, uncertain, long duration and labour-intensive. Therefore, managing projects of this kind should consider the intrigue nature and diversified interests the same way as making a policy so as to avoid unintended consequences (Ho, 2011) together with taking consideration of Down's Issue-Attention Cycle (1972) for the development of the intervening event.

The development of the case from start to end help explain that there are issues to be addressed beforehand. In this respect, public interest should be considered as a high risk factor in project planning because legal intervention arising from public interest is uncontrollable even though it can be handled in a way to minimize the effect. The applicant group should be made aware of the possible effect and collateral consequences of a project case, while the interests of other groups have to be considered as well. Since an un-anticipated event is one high risk factor that one may not be well prepared to solve the problem in time. In addition, it is also not too clear as how the increased cost is monitored at the implementation stage. Therefore, in managing cost and time matters for projects of a size as significant as the HMZB case, a project adviser or a team of advisors, with legal background, time and cost knowledge, should be assigned specifically to look after the projects. Above all, the case informed that the problem for the case was long established at a stage when the issues to be addressed had not been sufficiently attended to. If the conflicts are identified at an early stage and the stakeholders' interests and needs are accommodated and in particular those concerning public interest, the negative consequences can be avoided. Alternatively, the conflict can be handled differently such as mediation to avoid a minor problem to grow big.

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THE RIGHT TO SANITATION IN LEGAL FRAMEWORKS WITH REFERENCE TO URBAN INFORMAL SETTLEMENTSOF

KENYA, UGANDA AND RWANDA.

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Abstract:

The countries of Kenya, Uganda and Rwanda in East Africa have until recently viewed sanitation as a basic need left at the discretion of the state for progressive realisation subject to resources. In 2012, the United Nations General Assembly Resolution recognising the right to water and sanitation, and the United Nations Human Rights Council Resolution affirming the same rights, have put the states under a legal obligation to develop tools and mechanisms to enable rights approaches to implementing the right to sanitation. Express provisions in national constitutions and legislations and policies would be appropriate tools and mechanisms as they are foundational to providing for state agency duties, rights of groups, and responsibilities of all stakeholders in sanitation. Conducting a baseline study in the cities of Kisumu (Kenya), Kampala (Uganda) and Kigali (Rwanda) has established that sanitation, and the right to sanitation, has not been clearly understood and defined in legal frameworks and could be a factor exacerbating the sanitation crisis in the subject countries. Developing such legal frameworks centred on a right to sanitation is essential in the operationalization of the right to sanitation.

Key words:

Right to sanitation, informal settlements, East Africa

1. Introduction

Lack of improved sanitation is a crisis especially in the developing countries both in rural and urban areas of human settlements. About 2.6 billion people in the world[1] are not fully realising their human right to an adequate standard of living[2] because they have no access to

[1]See World Health Organisation and United Nations Children's Fund(UNICEF), Joint Monitoring Programme for Water Supply and Sanitation (JMP)"progress report on drinking water and sanitation special focus on sanitation, (2010,) p. 2 www.wssinfo.org. also found at http://www.who.int/topics/millennium_development_goals/en/ accessed on 24th of June 2012

[2]See A/HRC/10/6. In her report to the tenth session of the Human Rights Council, the independent expert(providing a detailed explanation of the decision to focus on sanitation) briefly explained that lack of access to sanitation has disastrous consequences for people's health, education, the economy, gender equality, and overall development.Lack of access to sanitation is overwhelmingly a problem of the poor, with women and children suffering the most.

improved sanitation[3]. The crisis in sanitation is said to be on the increase in urban areas with the creation of slums [4](otherwise referred to as informal settlements). Informal settlements have been defined as "residential areas where a group of housing units has been constructed on land to which the occupants have no legal claim, or which they occupy illegally; unplanned settlements and areas where housing is not in compliance with current planning and building regulations (unauthorized housing)"[5]. By the year 2010, the highest prevalence of informal settlements was found in sub-Saharan Africa where 62 per cent of the urban population were sheltered, followed by Southern Asia (35 per cent) and South-Eastern Asia (31 per cent). Particularly critical is the situation in conflict-affected countries, where the proportion of urban populations living informal settlements increased from 64 per cent in 1990 to 77 per cent in 2010[6].Rwanda is one of the countries in Africa where the aftermath of war and 1994 genocide has created a unique demographic dynamic as a result of an influx of refugees who returned to their home land after 35 years in exile and after genocide exacerbating the problem of water and sanitation infrastructure in urban areas. Most of the returnees opted to live, for security and employment reasons, in the capital city of Kigali where more than 70% of the city is occupied by informal settlements characterised by poverty and inadequate water supply and municipal sanitation infrastructures.

Although the right to sanitation has been recognised and acknowledged as being essential to the realisation of human rights by the United Nations General Assembly (UNGA) Resolution on 28th July 2010,[7]many countries that already have legal provisions for enforcements in sanitation have not utilised the imperatives of the right to extend services to the underserved and unserved areas such as informal settlements in urban areas of developing countries. Such areas are characterised by dense populations, lack of sanitation services, abject poverty and poor housing structures that are unplanned for by the state governments.

Following the (UNGA) Resolution, the United Nations Human Rights Council recognised that the right to water and sanitation is part of international law[8] and affirmed that the right is legally binding upon member states and called upon them "to develop appropriate tools and mechanisms to achieve progressively the full realisation of human rights obligations related to access to safe drinking water and sanitation, including in currently unserved and underserved areas."[9] However, there is neglect in understanding the implications of the right

[3] See JMP, (note 1),The classification of improved and unimproved sanitation isdeveloped by the JMP, for the purpose of monitoring access to sanitation, particularly in the context of the Millennium Development Goals and uses the term "improved sanitation" to refer to types of technology and levels of services that are more likely to be sanitary than "unimproved technologies."It considers excreta disposal systems as "adequate" as long as they are private and separate human excreta from human contact.

[4] See Lois Jensen United Nations;UN Statistics Division;2010,Millennium Development Goals website at http://mdgs.un.org ,the UN Millennium Development Goals website at www.un.org/millenniumgoals and the UN Millennium Campaign Office website at www.endpoverty2015.org states that "The number of urban residents living in slum conditions is now estimated at some 828 million, compared to 657 million in 1990 and 767 million in 2000".

[5] See Hofmann, P., Strobl, J., Blaschke, T. & Kux, H. 2008. 'Detecting informal settlements' in Elsevier[2009] volume 33 issue1 Accessed at http://www.elsevier.com/copyright.

[6]Lois Jensen note 4

[7] See the UN General Assembly Resolution A/RES/64/292; 28th July, 2010 that " calls upon states and international organisations to provide financial resources, help capacity-building and technology transfer to help countries, in particular developing countries, to provide safe, clean, accessible and affordable drinking water and sanitation for all".

[8] Universal Declaration of Human Rights (adopted on 10 December 1948) General Assembly Resolution 217 A (III) United Nations Document A/810, 71 (1948) (UDHR), International Convention on Economic Social and Cultural Rights (adopted on 16th December 1966) General Assembly Resolution 2200A (XXI) ,United Nations Document (ICESCR), and , International Convention on Civil and Political Rights (adopted on 16th of December 1966) General Assembly Resolution 2200A (XXI), United Nations Document (ICCPR)

[9] Human rights council resolution A/HRC/RES/15/9 on September 2010

to sanitation as an entitlement and a state obligation to create an enabling environment for minimum access to excreta disposal facilities (thus a toilet or adequate latrine) that can effectively prevent human, animal and insect contact with excreta, which ensure privacy and protect dignity, along with associated services such as sewerage or latrine exhaustion.[10]

Whereas states have the responsibility to enforce public health rules and regulations, local government by-laws, environmental laws on provisions of adequate and safe sanitation facilities by landlords , householders, institutions municipalities and water sanitation utilities and safe handling of human excreta before depositing it into the environment, the state government and regulating agencies in the water and sanitation sectors, are yet to comprehended to achieve universal affordable, and quality sanitation facilities and services to all citizens especially in urban areas.

With a focus on the urban informal settlements of Kisumu, Kampala and Kigali in East Africa,[11] there is a need to review the critical legal frameworks in these three countries to enable the progressive realisation of human rights obligations related to accessing sanitation in currently unserved and underserved areas. Examples can be drawn from what has worked in implementing this right in other jurisdictions. The national constitutions, laws, policies and enforcement practices need to be geared towards the full realisation of the right to sanitation so as to extend sanitation services to informal settlements.

2. Understanding sanitation in the countries of Kenya, Uganda and Rwanda

Improved and unimproved sanitation is a classification developed by World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) under the Joint Monitoring Programme (JMP) to describe sanitation facilities that prevent human, animal and insect contact with excreta, which ensure privacy and protect dignity, along with associated services such as sewerage or latrine exhaustion contact with human excreta while unimproved sanitation is the converse[12]. The classification primarily focuses on the types of technologies and levels of service that are more likely to hygienically separate human excreta from human contact.[13]The JMP uses this classification as a progress monitoring mechanism of accessibility of sanitation facilities. See Table 1.1 below for a summary of what is perceived as improved and unimproved sanitation facilities.

Table1.1 Classification of improved and unimproved sanitation

(Source: WHO/UNICEF Joint monitoring programme (JMP, 2010)

Improved sanitation	**Unimproved sanitation**
1.Flush or pour to flush connected to public sewer	1Pour flush to elsewhere
2.Septic tank	2 Bucket

[10] See Catarina de Albuquerque, A/HRC/12/24,July 2009

[11]A three year, multi-disciplinary research project is being conducted in Kenya, Uganda and Rwanda by the 3K-SAN project funded by the European Water Initiative ERA-NET ('SPLASH Consortium') involving the following partners: Robens Centre for Public and Environmental Health, Centre for Environmental Strategy and School of Law, University of Surrey; Institute of Policy Analysis and Research (IPAR), Kigali, Rwanda ; Department of Civil and Environmental Engineering, Makerere University, Kampala, Uganda; and, Victoria Institute for Research and Environmental Development (VIRED), Kisumu, Kenya. The aim is to identify and evaluate strategies for catalysing self- sustaining sanitation chains in low –income informal settlements in the cities of Kigali, Kisumu and Kampala in East Africa, (http://www.3ksan.org/)

[12] ibid

[13]Source: WHO/UNICEF Joint monitoring programme JMP, 2010

3.Ventilated improved pit latrine (VIP)	3 Open pit latrine without slab
4.Pit latrine with a slab	4 Bush or field or water body

The classification reveals open defecation in areas where people do not have sanitation facilities. Shared facilities on the other hand, in are where more than two or three households share one sanitation facility. The shared facilities are not classified by both JMP and the Water Supply and Sanitation Collaboration Council (WSCSC) as improved.[14]The implication of this is that there is more unimproved sanitation in the African case study cities than reported. However, the countries of Kenya, Rwanda and Uganda, do not seem to have delve beyond the classification of improved and unimproved sanitation facilities, in order to understand the sanitation crisis and issues that prevent access to improved sanitation. Such issues for instance, include increasing urban populations that are unplanned for, by municipal councils for basic services. The three selected cities for this paper fit the description given to third world cities as "having two distinct sectors of 'formal and informal', 'urban and peri-urban' also known as 'squatter settlements', 'shantytowns', 'urban slums', or 'illegal settlements."[15]

Other issues include old regulations insisting on prove of secure land tenure before connection to net-worked sanitation systems or other onsite improved sanitation systems such as septic tanks and Ventilated Pit Latrines (VIP). High poverty levels and utility networks and sanitation service providers are reluctant to invest in illegal settlements for instance on wetlands usually inhabited by poor populations at the same time governments not enforcing environmental regulations to allow only appropriate sanitation options for such terrains in order to protect health, and environment from contamination by human waste.[16]

Other unattended to issues include , failures to enforce rules and regulations on landlords and householders to provide adequate sanitation facilities to households leading to sharing of dilapidated facilities by most households in the informal settlements. Due to poor superstructures and unclean conditions, there is rampant defecation in urban informal settlements. This study argues that the unimproved sanitation situations are due to a lack of incorporation, implementation and enforcement of the rules and regulations that enable improved sanitation by the states, and that this is due to a lack of understanding of the human right to sanitation imperative to create an enabling environment for access to safe and adequate sanitation.

2.1 Kenya and Kisumu

The Kenya National Bureau of Statistics reported[17]that, Kisumu East district (which, at the time of census in the year 2009, was the only district covering Kisumu City Council (KCC)), was one of the most densely populated districts in Kenya, with a total population of 473,649,[18]and a

[14] See water supply and sanitation collaborative council website www.wsscc.org/
[15]William Steve Joyce and Eduardo A.P. 'the unique challenges of improving per-urban Sanitation' *wash technical Report no 86* (USA, 1993)pdf.usaid.gov/pdf_docs/pnabp615.pdf

[16]See detailed situational analysis of the countries of Kenya, Uganda and Rwanda in the diagnostic reports prepared by 3KSAN Project (see footnote 13 above)

[17] Government of Kenya; *Population and Housing Census* 2009 *A, B, C and VII. Report* 2010; Nairobi: Kenya National Bureau of Statistics (KNBS).

[18] See Government of Kenya; Kenya National Bureau Of statistics (KNBS 2009), 2009 Census report.

growth rate of 2.8%. This rapid population increase was attributed to migration, natural increase and the expansion of the municipal boundaries from 19 km^2 in 1969 to 297 km^2 at present[19] to include peri-urban areas. The physical expansion of KCC has not been guided by any form of urban planning. Development is said to be a "night mare….."[20]
About 60 per cent of the population is reported to be living in eight gazetted peri-urban informal settlements[21] which have a high rate of tenancy. Nyalenda A and B and Manyatta B, are on wetlands and largely have black cotton loose soils making construction of sanitation facilities difficult.[22]Some housing structures in the eight informal settlements are on government land and some on road reserves or on private freehold tenures and leasehold tenures. Table 1.2 below is an estimation of sanitation coverage for Kenya.

Table; 1.2 Estimated Urban Sanitation coverage for Kenya

(Source: WHO/UNICEF Joint monitoring report JMP, 2010)www.wssinfo.org

YEAR	IMPROVED	SHARED	UNIMPROVED	OPEN DEFECATION
1990	27%	42%	28%	3%
1995	28%	43%	26%	3%
2000	30%	45%	22%	3%
2005	31%	46%	21%	2%
2010	32%	48%	18%	2%

In Kenya as depicted in table 1.2 sanitation progresses from 31% in the year 2005 to 32% in could only be read as negligible since at the same time, shared facilities increased as well as unimproved facilities increased and open defecation remained constant. This clearly shows very slow progress in improvement in access to sanitation in the country. These figures are for both rural and urban areas of the country of Kenya.

The municipal council of Kisumu is the owner of infrastructure to sewerage drains on sanitation services such as the sewer lines and treatment plants which although have been leased to the Lake Victoria Water service Board (LVWSB) for the use of a private company known as Kisumu Water And Sewerage Company (KIWASCO). The company is wholly owned by the Kisumu City Council. Only 10% of Kisumu is served with sewerage systems. This covers only part of the planned areas of the city. The informal settlements rely on overused and poorly maintained pit latrines. Table 1.3 below shows the mode of human waste disposal in the city council of Kisumu.

[19]Okotto, L. (2010) Independent and Small-scale Water Providers in Kenya and Ethiopia. Unpublished PhD. Thesis University of Surrey

[20] The Kisumu situational analysis UN-HABITAT 2008

[21] UN-HABITAT 2008, situational analysis of Kisumu ; notes that there are eight gazetted informal settlements in kisumu , being " Manyatta, Nyalenda, Obunga, Kaloleni ,Bandani, Manyatta Arab, Nyamasaria

[22] Maoulidi, M. (2010) 'A water and sanitation needs assessment for Kisumu City, Kenya' Columbia Earth University; Millennium Cities Initiatives. Online www.earth.columbia.edu/mci accessed November 2011

Table 1.3 Mode of human waste disposal informal settlements in Kisumu (Kenya)

(Source;Maoulidi M. 2010)

Mode of Human Waste Disposal	**Percentage Of Households**
1.Main Sewer	1.3%
2.Septic Tank	0.7%
3.Cess Pool	0.7%
4.Pit Latrine without slab or not covered	80.1%
5.Bush	17.5%
6.Other/ water bodies	0.3%

Pit latrine without slab or not covered is included in the definition of unimproved sanitation as it does not keep away flies and smell. The on-going 3K-SAN research has begun to reveal that up to 1.3 % of sewage can leak into the environment while a good portion of the 0.7 % septic tanks is built without reference to an engineering specifications or control of the Kisumu city council and overflows into the environment. The on-going research is revealing evidence of open defecation and incidences of emptying of exhausted sludge from pit latrines into bushes, open spaces and water bodies in the informal settlements.

2.2 Uganda and Kampala

The city of Kampala's physical layout and creation of informal settlements with inadequate sanitation is attributed partly to its history dating back to 1600s when it was established as the Capital or (Kibuga) of what was then Buganda Kingdom. In the Buganda agreement of 1900 the British crown and leaders of the Buganda Kingdom, who were then Britain's ally, divided the country between them. The effect of this agreement on the land tenure system is that the area around Kampala was split into two: one part being administered by the Buganda Kingdom the Kibuga; and, one part by the British. The Kibuga was separated from the municipality and had a different land tenure system (mailo).

The Kibuga housed a highly traditional culturally regarded urban African community and was growing, with unplanned structures and dwelling units devoid of toilets and water supply, drainage, sanitation and solid waste management systems[23].Kampala has continued to have a dual urban form, which is attributed to the separation of the local Kibuga from the township or municipality. The former was largely unplanned and unsanitary while the latter was fully planned and highly controlled. Kampala City Council (KCC) has been blamed for failure to implement/enforce planning schemes. Responsibility for this is also placed on

[23] Stephen W. Giddings; International Housing Coalition 109.street N E. Suit 480 Washington D C 2002 accessed at info@intlhc.orgwww.intlhc.org

continued political interference, conflicting land use policies, and uncoordinated planning between KCC and the Ministry of Local Government[24].Thus there is growth of unplanned informal housing, and challenges related to solid waste accumulation, wetland encroachment and destruction, water pollution and changes in land use that are reducing the ecological services from the natural environment of the metropolitan area.[25] As a result, the living environment of the urban poor in the city is deplorable with poor sanitation, inadequate housing, poorly managed solid and human wastes, increased water pollution and reduction in ecological services[26]. Table 1.4 below give the sanitation coverage for Uganda. Please note that the coverage is for both rural and urban areas.

Table 1.4 Estimated Urban Sanitation coverage for Uganda

(Source: WHO/UNICEF Joint monitoring report JMP, 2010)*www.wssinfo.org*

YEAR	IMPROVED	SHARED	UNIMPROVED	OPEN DEFECATION
1990	32%	48%	17%	3%
1995	33%	48%	17%	2%
2000	33%	49%	16%	2%
2005	34%	50%	14%	2%
2010	34%	50%	15%	1%

In Kampala some informal settlements are on gazetted wetlands and are therefore declared illegal due to conservation law. Some informal settlements are on privately owned freehold and leasehold tenures that although not illegal are not under the jurisdiction of the Kampala city council obligation to plan those privately owned lands and provide services.[27]The authorities do not approve or regulate sanitation facilities in illegal settlements as they are viewed as temporary waiting for eviction and demolition. This raises the issues of pollution control from private properties. The conditions of sanitation facilities in the informal settlements in Kampala are very poor as shown in table1.5 below.

[24] Stephen W Giddings 2002.(note 25 above) www.intlhc.org
[25] See Matagi 2009/10; report by Government of Uganda ; National Environmental Management Authority (NEMA) accessed at www.nfa.org.ug/pdf/NFA%20Business%20Plan%2030062009.pdf.
[26] Ibid
[27]UN-HABITAT 2008

 ISBN: 978-1-84219-840-7 .

Table 1. 5Condition of sanitation facilities in informal settlements of Kampala, Uganda

(Source: Okot Okumu 2008)

Observed condition	Health and safety implication
Unclean condition with observed faeces and wet floor, bad smell, no hole cover	Risk of disease transmission by contact contamination and transmission agents like flies.
Flies within and around the sanitation facility, cockroaches and rodents	Risk of disease transmission by the observed agents
No sanplats or slabs	Risk of accidental collapse
Too close to housing and water points	Risk of water pollution, disease transmission
Dilapidated state of the sanitary structures	Risk of environmental pollution, lack of safety of users, disease transmission
Sullage from bathing and urinal shelters discharged in open drains, grey water pools	Risk of disease transmission by contact contamination especially among children, environmental contamination including water points
Faecal matter disposed in polyethylene bags, faeces littering compound and waste dumps	Risk of disease transmission by contact contamination especially among children, environmental contamination including water points
No hand washing facility at latrines	Risk of human to human contamination

2.3 Rwanda and Kigali

At independence in 1962, Kigali's population was 6,000. Since then, the City has experienced a high population growth rate resulting in an urban population estimated at 44 per cent of the total urban population in Rwanda. The population growth has occurred, however, without adequate physical planning and with unplanned urban growth, resulting in sanitation problems with significant implications for public health, especially for the urban poor due to inadequate and unsafe drinking water, poor drainage and sanitation conditions, solid waste

disposal hazards and construction in inappropriate and hazardous areas due to unplanned urban development. It is estimated that 80% of urban dwellers in Rwanda live in informal settlements.

In the City of Kigali, access to sanitation is a challenge even in middle and high-income households. This situation is worse in informal settlements where the high density of housing increases the negative health implications of both open defecation and unregulated emptying of pit latrines. This is due to the fact that the sanitation chain is poorly organized and regulated. The lack of private incomes is exacerbating the situation. Poverty in the informal settlements creates difficulties for Community Based Organisations and companies to grow to invest in sanitation infrastructures since investments returns may be difficult to realise. Re-use of faecal matter is limited to prison institutions and are not affordable for poor households in informal settlements. Table1.6 below shows sanitation coverage in Rwanda.

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Table 6 Estimated urban Sanitation coverage for Rwanda

(Source: WHO/UNICEF Joint monitoring report JMP, 2010)*www.wssinfo.org*

YEAR	IMPROVED	SHARED	UNIMPROVED	OPEN DEFECATION
1990	69%	24%	4%	3%
1995	64%	23%	11%	2%
2000	60%	21%	17%	2%
2005	56%	20%	22%	2%
2010	56%	18%	29%	1%

Decentralized, on-site sanitation systems are the only mode of excreta management systems that exist in Kigali while informal settlements of Kigali are characterised by traditional pit latrines .The large number of pit latrines in informal settlements makes it difficult for inspectors to ensure sanitation is up to public health and environmental standards. Table 1.7 below is a finding of mode of human waste disposal in two informal settlements in Kigali that are research sites for the 3KSAN project.

Table 1.7 Mode of human waste disposal informal settlements of city of Kigali

Source: (strategic marketing research and consulting, 2011)

Water and Sanitation Services	**Kimisagara** **% of households**	**Gatsata** **% of household**
Main water supply is piped water	98%	69%
Outside pit latrine	84%	71%

Indoor flush toilet	3%	4%
Outdoor flush toilet	2%	3%
Households with own latrine (sum of the three figures above)	89%	78%

From the tables it is evident that progress has occurred in accessing improved sanitation services. However, it has been noted that the progress largely bypasses the urban poor living in slum conditions in developing regions.[28]

The city of Kigali is undertaking major land reforms and resettlement policies of informal settlements by re-locations and upgrading. This will have an impact on sanitation services in the future.

3. The implications of the right to sanitation in legal frameworks of Kenya, Uganda and Rwanda

The governments of Kenya Uganda and Rwanda are signatories to international conventions and regional treaties that have provisions in favour of the right to sanitation in an implied manner.[29]These three countries are bound by the international law on the right to sanitation.[30] The international law is "a solid basis for holding the governments accountable for protecting the full spectrum of human rights of all citizens including those in informal settlements and for promoting national legislative, policy and other initiatives which comply fully with the international standards that the States have ratified"[31].With the recognition of the right to sanitation in international law, the countries need to have constitutional express provisions for the right to sanitation to operationalize the right to sanitation. Entrenched constitutional provisions have been said to 'enable further actions including the development of legislation, improved enforcement in courts, and generate political discourses; enactment of legislation is necessary to specify the duties of service providers and rights entitlements of individuals. In the case of Rwanda for instance, where many institutions are in charge of sanitation with almost similar mandate, express provisions in legal frameworks may lead to accountability.[32]

[28]JMP, (note 1,8,and 9 above)
[29] Universal Declaration of Human Rights (UDHR), adopted in December 1948 from resolution 217A articles 1,2,4,7; Covenant on Economic, Social, and Cultural Rights (ICESCR, 1966) Article 2 (3), 3, Covenant on Civil and Political Rights (ICCPR, 1966) articles 26 and the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) 1979.
[30] Ibid (32 above)
[31] See comments by COHRE 2008, in "legal resources for the right to water and sanitation international and national standards" source 8, 2nd edition cohre@cohre.org web www.cohre.org/water.
[32]Republic of Rwanda :Ministry of Infrastructure in charge of "Implementation of investment and labour intensive water and sanitation projects, Ministry of Health "promote sanitation, healthy standards and regulations for water and sanitation, funding, …Ministry of Natural Resources "Define the overall policy of water and sanitation, mobilise funds for the sanitation sector….Ministry of Local Government "Ensure good governance in all local administration levels including environment governance at local level, playing an intermediary role in channelling funds for development projects, over-seeing Vision 2020 Umurenge, *Haute Intensite de Main d'Oeuvre* (HIMO), *Ubudehe* and Community Development Fund(CDF) … .Rwanda Environment Management Authority "Sets up Environment Standards and Regulations (e.g. Environmental Impact Assessment, etc.) to monitor, inspect and ensure compliance with environmental awareness, ….

The areas for review in constitutions, key laws and policies to expressly provide for components of the right to sanitation, include: recognition and entitlements of the right to sanitation to all people, allocation and availability of sanitation facilities and all related services, safe and good quality of sanitation facilities and services, affordability of facilities and related services; physical accessibility, non-discrimination, cultural acceptability and attention to marginalized and vulnerable groups, participation and access to information, monitoring and complaint procedures and international cooperation[33]. It is beyond the scope of this paper to review all key legal frameworks in all thematic areas. In reviewing the law, states are to ensure that persons whose right to sanitation has been denied, have access to effective judicial, administrative or other appropriate remedies at the national level, and should be entitled to adequate reparation.

3.1 Right to sanitation in legal frameworks of Kenya

Kenya has expressly provided for the right to sanitation in article 43 1(b) of the Constitution 2010 as follows:

> "Every Kenyan is entitled to adequate standards of housing and reasonable standards of sanitation."

It has also provided for easy access to justice in the courts in article 22 of the Constitution 2010 to enable the indigent whose rights are violated. In the event they are not able to come to court as individuals they may do so as the subject of public interest litigation. This has happened in other jurisdictions[34].The right to sanitation has however not been incorporated into legislation. In South Africa this has been the case, and has led to easy implementation of minimum requirements of sanitation services and agitation in courts for socio economic rights.[35]As a result of the express provision of the right to sanitation in the constitution in Kenya the civil society has become very active in several in public interest litigation to agitate for enforcement of social economic rights including sanitation and against evictions from informal settlements[36].

The laws of Kenya need a review to be in tandem with the constitutional provisions of the right to sanitation. These includes the Local Government Act 1963[37] of Kenya which provides that "the applicant for development of building means the owner, lessee or occupier of land or premises and includes his duly authorised agent or representative"[38] implying that if one has no title or access to secure land tenure, one will not succeed in applying for a development plan for development of a dwelling place with a sanitation facility that is

[33] COHRE 2008

[34]See for availability and allocation of sanitation facilities in Municipal Council, Ratlam v. Shri Vardhichand & Others, Supreme Court of India on 29 July 1980(1981) SCR (1) 97; also available at: http://www.judis.nic.in/supremecourt/qrydisp.aspx?filename=4495.Where the Municipality was ordered to improve sanitary conditions and to build public conveniences in a case that dealt with the appalling sanitary conditions in the municipality of Ratlam. As the municipality was not providing any sanitary facilities on the roads nor public conveniences for slum dwellers, people living in informal settlements were using the road for that purpose.; also available at: http://www.judis.nic.in/supremecourt/qrydisp.aspx?filename=4495.

[35]See Republic of South Africa ; Water Services Act, Act 108 of 1997, last amended 2004 in its Preamble "Recognising the rights of access to basic water supply and basic sanitation necessary to ensure sufficient water and an environment not harmful to health or well-being ...Section 1: Definitions In this Act, unless the context shows that another meaning is intended–… basic sanitation means the prescribed minimum standard of services necessary for the safe, hygienic and adequate collection, removal, disposal or purification of human excreta, domestic waste-water and sewage from households, including informal households…"

[36]Susan Waithera Kariuki and 4 others Vs. Town Clerk Nairobi City council and 2 others KLR HCC no. 66 of 2010 eKLR *www.kenyalaw.org*

[37] Government of Kenya, Local Government Acts 1963 chapter 265 laws of Kenya

[38] See government of Kenya Physical Planning Act (building and development) (control) rules 2 , 1998

approved by the law. In the case of informal settlements, most tenants would be eligible as occupiers to make the investment, however, are hampered by the tenancies being unwritten.

In the City Council of Kisumu, developments of properties in informal settlements can only enjoy access to sanitation facilities such as sewer lines, depending on the proximity of the property to other developed areas. Accessing sewerage lines remains a major problem, due to the small size of many of the plots and the narrow and unsystematic access roads that do not allow for construction of sewer reticulation. Installation of on-site sanitation that is regulated and serviced by the city council of Kisumu, Lake Victoria South Water Service Board,(LVSWSB) and Kisumu Water And Sewerage Company (KIWASCO), is by agreement where "the owner must install sanitation services specified by the water service provider in the water services regulations that only include "a VIP latrine, septic tank, French drains, conservancy tanks, specified in rules 100 to 103[39]. Stringent securities of tenure requirements to acquire the on-site sanitation as basic minimum sanitation service by the public utility in the informal settlements accompany these specifications[40]. This may raise issues of affordability. The law has not been reviewed to incorporate alternative technologies which have been piloted elsewhere in the country and are highly recommended for extension of minimum access of sanitation to the informal settlements.[41] Perhaps reviewed laws may enable installation of better workable and acceptable technologies in the informal settlements.

Constitutional protections of private property exist in Kenya with implications of high compensations costs to private owners to give way for public utilities such as sanitation systems for public use. The Government of Kenya at national local or county level may under article 66 of the Constitution of Kenya 2010,[42] "regulate the use of any land, or any interest in or right over any land, in the interest of public safety, public order, public health, or land use planning among others." However, under Article 40 (3) (b), in the event that such land is compulsorily acquired by the Government, it is required that " prompt payment in full, of just compensation to the person may be made; besides, the constitution allows any person who has an interest in or right over, that property, a right of access to a court of law.

3.2 The right to sanitation in legal frameworks of Uganda

The Constitution of Uganda 1995[43] does not expressly recognise the right to sanitation. The Constitution, however, provides that "the state shall take all practical measures to promote a good water management system at all levels and shall protect important natural resources, including land, water, wetlands, minerals, oil, fauna and flora on behalf of the people of Uganda"[44]. The other constitutional provision in Uganda relevant to sanitation is XXVII, that "every Ugandan has a right to a clean and healthy environment" and that "the state shall promote sustainable development and public awareness of the need to manage land, air and water resources in a balanced and sustainable manner for the present and future generations". Articles XVII states that society and state shall recognise the right of persons with disabilities with respect and human dignity.

[39] Government of Kenya "The water services regulations; rule 100-114 on VIP latrine.

[40] See Government of Kenya, Water rules 89, 90, 100,-103 0f the water services regulations 2010.(Note43 above)

[41] See COHRE & Umande Trust; 2007"The right to water and sanitation in Kibera Nairobi" where they highlight the advantages of "ecological sanitation…"

[42]Government of Kenya; Constitution 2010 government printers Nairobi.

[43] Republic of Uganda ; the constitution of the republic of Uganda as at 15th February 2006; Uganda printing and publishing corporation

[44] Article XIII Constitution of uganda 2005

Article XXI provides that "the state shall take all practical measures to promote a good water management system". With regards to sanitation, the city of Kampala has served its urban residents with sewerage systems, on-site sanitation in the form of septic tanks and allowed small scale sanitation service providers to operate exhaustion services in the informal settlements from pit latrines. However, there are a lot of constraints for the City Council of Kampala to extend sewerage mode of human waste disposal to the informal settlements, chief of which are the constitutional and legislative protections of private property ownership in the informal settlements[45] .

Control of orderly developments in the city by the city council of Kampala has been hampered by the land tenure rules in the Land Act of 1998[46] which recognize four types of land tenure systems in Uganda. Section 2 of the Act, stipulates that all land, "shall be owned in accordance with the following land tenure systems—(a) customary; (b) freehold; (c) mailo; and (d) leasehold. Most land in Uganda—70% to 80%—is held under undocumented customary tenure. There are constitutional protections of these private property ownerships in informal settlements of Kampala. Article 26 of the Constitution of Uganda 2005, protects citizens of Uganda against deprivation of private property by providing that citizens have "a right to own property either individually or in association with others and shall not be compulsorily deprived of property or any interest in or right over property of any description except where the following conditions are satisfied—(a). The taking of possession or acquisition is necessary for public use or in the interest of defence, public safety, public order, public morality or public health; and(b) The compulsory taking of possession or acquisition of property is made under a law which makes provision for— (i) prompt payment of fair and adequate compensation, prior to the taking of possession or acquisition of the property; And (ii) a right of access to a court of law by any person who has an interest or right over the property"[47].

These provisions have been noted[48] to hamper extension of sewer lines and investments in sanitation infrastructures in Kampala's informal settlements because of high costs of compensation to landowners, and other tenure claimants before one can install drains and access roads to interior premises. Any meaningful sanitation developments that have taken place in the recent past in the informal settlements has been through leasing of property from landlords for a period of twenty years in order to install public toilets. Even then, the political balance between landlords and the council has meant that, in fact, the council has been able to exert little control of facilities.[49]

3.3 The right to sanitation in legal frameworks of Rwanda

The Constitution of Rwanda 2003 provides for environmental protection in article 4 which states that "each citizen has the right to a clean and healthy and satisfying environment." there is also a corresponding duty on "each individual to protect, conserve and promote the environment, which is reinforced in the Environment Protection and Management Act

[45] Nyakaana, J.B; Sengendo, H & Lwasa, S. (2007). Population, Urban Development and the Environment in Uganda: The Case of Kampala City and its Environs. Paper presented in a conference, Nairobi: Kenya
[46] Government of Uganda land act of 2005
[47] Government of Uganda Constitution of Uganda 2005
[48] Constitution of Uganda 2005
[49] Nyakaana, J.B; Sengendo, H & Lwasa, S. (2007). Population, Urban Development and the Environment in Uganda: The Case of Kampala City and its Environs. Paper presented in a conference, Nairobi: Kenya

(EPMA) number 4 of 2005.Under article 4 of the constitution, the government has the overall responsibility to conserve, protect, and promote the environment by implementing and enforcing EPMA 2005 which it does through Rwanda Environmental Management Authority (REMA).

Under article 74 of EPMA, REMA is mandated to investigate and prosecute offences against environment as stated in the laws. In article 60, REMA shall carry out policing in collaboration with the people of Rwanda who have a duty to keep the environment clean, the decentralised entities such as the City Council of Kigali, district sectors and communities that shall be responsible for the implementation of laws, policies, strategies, objectives and programmes relating to protection, conservation and promotion of the environment in Rwanda. Article 62 stipules that decentralised entities have the responsibility of designing plans of collecting and treatment, piling of domestic waste, removal of any other waste in any possible way depending on its nature and quantity, its treatment and disposal.

Offences specific to sanitation are in Article 87 of EPMA, which prohibits construction of houses in wetlands (rivers, lakes, big or small swamps), in urban or rural areas and building of a sewage plant and any other buildings that may damage such a place in various ways". It further provides that "all buildings shall be constructed in a distance of at least twenty (20) metres away from the bank of the swamp. Article 3 of the (EPMA 2005) regulates the behaviour and practices of people who deposit; abandon or dump waste, material or who pour sewage in a public or private place while article 81prohibits among others, "dumping or disposal or damaging the surface or underground water; defecating or urinating in inappropriate places; spitting, discarding mucus and other human waste in any place. The penalty for these offences is "a fine ranging from ten thousand to one hundred thousand Rwandan franks except if such a place has been designated for dumping by competent authorities".

However, REMA reports that "Kigali is sinking under the weight of its rubbish and sewerage".[50]This situation may be explained by several factors including that Rwanda Environment Management Authority (REMA) and decentralised entities (City of Kigali, Districts and Sectors) which are responsible for law enforcement do not have sufficient qualified staff to deal with technical issues. Another factor is that, REMA has not yet published clear standards and guidelines for discharging wastewater in the environment; they do not have legal instruments for law enforcement. In addition, through the Organic Law on Environmental Protection, Conservation and Management, Rwanda Environment Management Authority is mandated to establish modalities and regulations for the collection and use of the environment-protection fees.

Conclusions

This paper set out to argue that there is neglect in understanding sanitation and defining the right to sanitation as an entitlement and a state obligation comprising, at a minimum, access to excreta disposal facilities (a toilet or adequate latrine) that can effectively prevent human, animal and insect contact with excreta, which ensure privacy and protect dignity, along with associated services such as sewerage or latrine exhaustion. We have seen that several factors or issues are causal to the creation of informal settlements where large populations are confined to inadequate standards of living due to unimproved sanitation. The classification into improved and unimproved sanitation is narrow for monitoring progress in accessing

[50]Government of Rwanda ; the Rwanda Environment Management Authority(REMA) Report on the status of environment , 2010

sanitation by unserved and underserved in informal settlements because it does not seem to reveal the real reasons causing large populations to have unimproved sanitation such as poverty, access to interests in land, uncontrolled urban development leading to cheap housing without appropriate sanitation facilities.

This paper set out to show that sanitation as a right, if formerly recognised in the legal frameworks, may lead to open channels for legitimate civil society actively to claim that right. In Kenya, the right has been expressly recognised in the constitution and there are further examples of cases from India and South Africa. On the other hand, in Uganda and Rwanda there is no express provision for the right to sanitation. It can be concluded that express provisions of the right to sanitation may lead to the activation of civil society to demand improved sanitation as has been the case in Kenya and India as demonstrated in the case law. Sanitation has been broadly grouped into wide environmental concerns in the case of Rwanda and Uganda encompassing protection of natural resources, such as rivers wetlands land, which understanding may obscure a focus and understanding of sanitation as management of human excreta and its safe management as defined herein above. There is no clear emphasis on sanitation as not only a public health issue but also as a right of its own standing in both Uganda and Rwanda. In the case of Kenya although the right to sanitation has been recognised it needs awareness rising to enable accountability from the government and other actors in the sector.

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A REVIEW AND CASE STUDY OF STRATEGIC CARBON MANAGEMENT IN UK HIGHER EDUCATION SECTOR

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ABSTRACT

Climate change is arguably one of the greatest environmental challenges facing the world today, bringing organisations under increasing pressure from government, shareholders and stakeholders to reduce carbon emissions. The Higher Education (HE) sector has a significant social and economic impact and is not exempt from challenging carbon reduction targets, in fact, it is argued, should be demonstrating leadership in the field. The term 'carbon management' is popular in the literature but strategic carbon management (SCM) is an under-developed and under-researched area as it is an applied concept, especially within the HE sector. Scope 1 and 2 emissions reduction initiatives have received more attention than scope 3 thereby missing a significant opportunity for fully effective carbon reduction. These gaps have been identified through analysis of the academic and practitioner literature, reports, and websites. The study proposed in this paper will look into the gaps and possible future research direction of SCM in the HE sector through a case study of De Montfort University (DMU). It will explore how carbon emissions can be reduced strategically and develop a systematic and comprehensive strategic management approach to doing so. Finally this paper makes some provisional principles for transferable best practices for the HE sector.

Keywords: climate change, carbon management, higher education, stakeholders, strategic management.

INTRODUCTION

The motivation for this research comes from the widely-accepted need to greatly reduce the carbon dioxide and other greenhouse gases (GHG) emissions in order to mitigate anthropogenic climate change (IPCC 2007). The Stern Review report suggests that a 25% reduction below current levels of emissions is required in order to stabilize global CO_2 concentrations at levels that will not have very adverse impacts (Stern Review 2006). The UK government passed the Climate Change Act 2008 as its long-term legally binding framework to tackle climate change under its Kyoto commitment. Carbon management is moving up the corporate agenda and

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organisations now understand the need to handle their emissions. It must be embedded through the business (Carbon Disclosure Project 2010).

The Higher Education (HE) sector is not exempt from this challenge and needs to play its part in both meeting the national carbon reduction targets and demonstrating the leadership (HEFCE 2010a). In 2005 the HE sector in England emitted 5.4 million tonnes of carbon dioxide and through pressure from the Higher Education Funding Council for England (HEFCE) is being strongly encouraged to show leadership by reducing its emissions (HEFCE 2011). Carbon management is slowly becoming a strategic management issue for universities' senior management due to HEFCE's carbon emissions targets and strategies. Guidance has recently been published by HEFCE on monitoring and measuring scope 3 emissions (Procurement, travel, waste and water) (HEFCE 2012) and universities like De Montfort University (DMU) are developing ambitious carbon management plans for scope 1, 2 and 3 emissions.

The aim of this paper is to identify a potential gap in the academic literature of Strategic Carbon Management (SCM) and discuss the potential role of the HE sector in achieving substantial carbon reduction. It starts with the history of carbon management and then introduces the issue associated with the development of SCM in the HE sector and then within DMU. It will consist of findings from the existing academic, non academic literature, policy and strategic documents. It also provides a systematic analysis and discussion on SCM within the HE sector and identifies themes and potential gaps to be further researched. The final part of the paper summarises the methodological and theoretical implications associated with SCM and makes recommendations for how this process can be moved forward.

CARBON MANAGEMENT

In recent years, the climate change and carbon management debate has dramatically risen up the public agenda. The emphasis in the past has been on the science involved, and communicating the extent humans are affecting the global environment; this is now widely accepted that humans are impacting the natural environment (Kolk & Hoffmann 2007). Over the last few years, some interesting studies on organisations' carbon management have emerged (Čadež and Czerny 2010). Liu (2012) states carbon management as any corporate effort to address and reduce the impact of a firm's business activities on climate change, although not all greenhouse gases directly relate to carbon but these are included in the definition of carbon management in terms of their carbon dioxide equivalents. The established measures of carbon management have focused on specific fields such as a reduction in GHG emissions, development of low-carbon technology and clean energy and the adjustment of economic structures. Organisational structure and business models have contributed to the progress of carbon management but step changes are still needed (Liu 2012).

Carbon management strategies provide an interesting research stream and Pino et al. (2009) put forward six components of them; verifying the data of greenhouse gas (GHG) emissions, setting and updating performance targets, identifying cost-effective emissions reduction, internal communication management, finding new business opportunities and adapting to market-based solutions. The acknowledgement of the growth of climate change and the subsequent business response of organisations is by no means widespread (Kolk & Hoffmann 2007). Debate still ensues as to why some organisations are responding to climate change and others are not. The literature on

carbon management and other associated issues remains in its infancy, and thus provides a good opportunity for further research (Jackson 2008). A study of corporate carbon strategies of Korean companies' suggests that companies have started considering the carbon issue in their overall strategic positioning. A comprehensive theoretical framework has been developed from the Industrial Organisations (IO) theory which divides carbon management activities into six categories: emission reduction commitment, product development, process and supply improvement, new market and business development, organisational involvement and external relationship development (Lee 2012).

Management studies claim that there is a business case for companies to address climate change through adequate carbon management strategies. Thus, climate change constitutes a business relevant issue and that companies are able to increase their competitiveness by implementing carbon management strategies (Busch and Wolfensberger 2011). Corporate carbon management is not limited to mitigation efforts internally but also comprises of supply chain optimisation, product-related improvements, and compensation activities (Busch and Wolfensberger 2011). Our initial analysis shows that there is an established literature on the corporate response to climate change and carbon reduction strategies. Other researchers have developed strategy frameworks. For example, Hoffmann and Weinhofer (2010) noted that we understand a company's CO_2 strategy as 'a pattern in action over time' intended to manage its direct and indirect carbon emissions. A framework is developed that conceptualizes a company's CO_2 strategy as the focus of one or a combination of several strategic objectives: CO_2 compensation, CO_2 reduction and carbon independence (Hoffmann and Weinhofer 2010). Horgan (2011) has also developed a carbon management hierarchy as shown below.

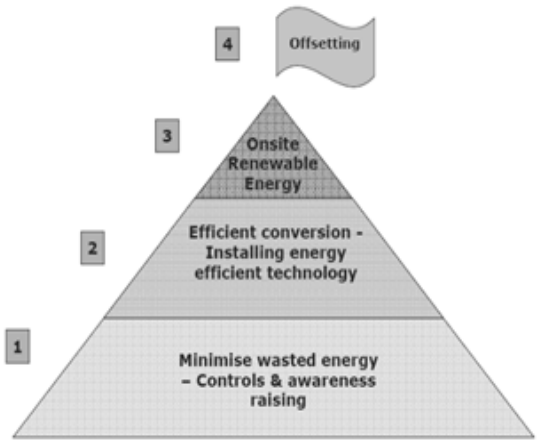


Figure 1: Carbon Management Hierarchy (Source: Horgan 2011)

STRATEGIC CARBON MANAGEMENT (SCM)

Research framework:

As climate change has emerged as a legitimate business concern; academics have attempted to gain a better understanding offirms' carbon strategies by characterizing their climate change response (Lee 2012). The actual and potential strategic impacts of climate change on companies are intensifying (Kolk and Pinkse 2005). Management research on the topic of corporate carbon strategies within the organisations is still a relatively new endeavour though a few studies have analysed

firms' responses to climate change from a strategic perspective. Yet most of the studies of corporate carbon strategies have examined large-sized and international firms (Lee 2012). Increasing regulatory pressure, public opinion, and environment oriented consumers and financial institutions have led companies to consider climate change in their strategic management (Hoffmann and Weinhofer 2010).

The strategic importance of carbon is expected to grow over the next ten years and will be embedded in the business as a long-term priority (Carbon Disclosure Project 2010). Strategic Carbon Management (SCM) is an approach to address the carbon and financial cost of an organisation's operations. Strategic management of carbon is complex and starts with understanding the ways carbon management can affect the organisations' activities – both tangible and intangible. For example, the operational aspects such as process efficiency and alternate energy sources, regulatory aspects, or possible impacts on company reputation based on stakeholder perceptions, carbon has the potential to impact the bottom line (Two Tomorrows Group 2012).

SCM provides an understanding of the way in which organisations are translating strategic issues into management actions in the context of their carbon impact. It is needed to examine the strategic response of organisations to the challenge of carbon reduction. Organisations need to consider climate change in a strategic context and to integrate carbon management issues into their long-term decision making process. SCM will provide an effective approach to issues such as capital costs of investment, strategic decision making, carbon reduction target setting, sourcing funding, building business cases and winning internal support in an organisation (Deloitte 2012). This is not simply about reducing the organisational carbon footprint, but taking into account

> *"how the organisation is thinking about carbon and thinking about what it needs to do for adaptation and contribute towards sustainable development in the context of the decisions and the duties it undertakes" (Barter and Bebbington 2011, p. 2).*

Managers and boards in most industries are beginning to come to terms with new realities of a carbon-constrained economy and emphasise to take a strategic approach. It helps to unearth opportunities to gain competitive advantage over your rivals by developing the strategies. The bottom line is that carbon, just like capital, human resources and products, is now a strategic part of the new competitive game (Schultz and Williamson 2005). A survey revealed that although 60% of the 2,000 responding executives thought that climate change was an important consideration within their company's strategy, translation into actions remained limited (McKinsey 2008).

Life cycle wide emissions:

Corporate carbon management is not only limited to mitigation efforts in the organisation but it also comprises of supply chain optimisations, product-related improvements, and compensation activities. A life-cycle context is relevant for corporate competitiveness and a framework of eight carbon management strategies has been developed based on the Industrial Organisations (IO) literature and each strategy of the framework contributes to the potential competitive advantage (Busch and Wolfensberger 2011). The companies are now aware of life-cycle wide thinking of assessing the environmental impacts because of the intensifying stakeholders' pressure to manage it (Busch and Wolfensberger 2011). Examples are the Carbon Disclosure Project (CDP) and the California Climate Action Registry (2009). Both accelerate the discussion on scope 3 emissions as per Greenhouse Gas Protocol

Standard (World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) 2004).

SCM routemap:

Ansoff (1980, p. 133) suggests that

> *"a strategic issue is a forthcoming development, either inside, or outside the organisation, which is likely to have an important impact on the ability of the enterprise to meet its objectives".*

What Ansoff (1980) suggests is that while firms might face a variety of issues (including those that are social), only certain ones are considered significant enough to impact the ability to fulfil corporate objectives. Horgan (2011) has provided a comprehensive SCM routemap detailing various strategic issues for public sector organisations to reduce their emissions. It involves the integration of various themes within the process; most common are low carbon culture, low carbon strategy, stakeholders' engagement, low carbon procurement, financial case, metering and monitoring and performance evaluation. It also involves a five step approach to carbon/energy management starting with senior management's commitment to the monitoring and controlling the carbon/energy performance. Environmental performance is a strategic issue and needs strategic intention which adds value in terms of strategic competitive advantage. Worthington and Patton (2005) in their studies of Small and Medium Enterprises (SMEs) in the UK screen-printing sector have discussed management decisions and implications lack in strategic orientation and innovative response is needed within the companies for both demand and supply sides benefits. We will now look at the role of SCM both within the UK's HE sector and a specific case study example.

STRATEGIC CARBON MANAGEMENT - HE CONTEXT

Overview of the Higher Education sector:

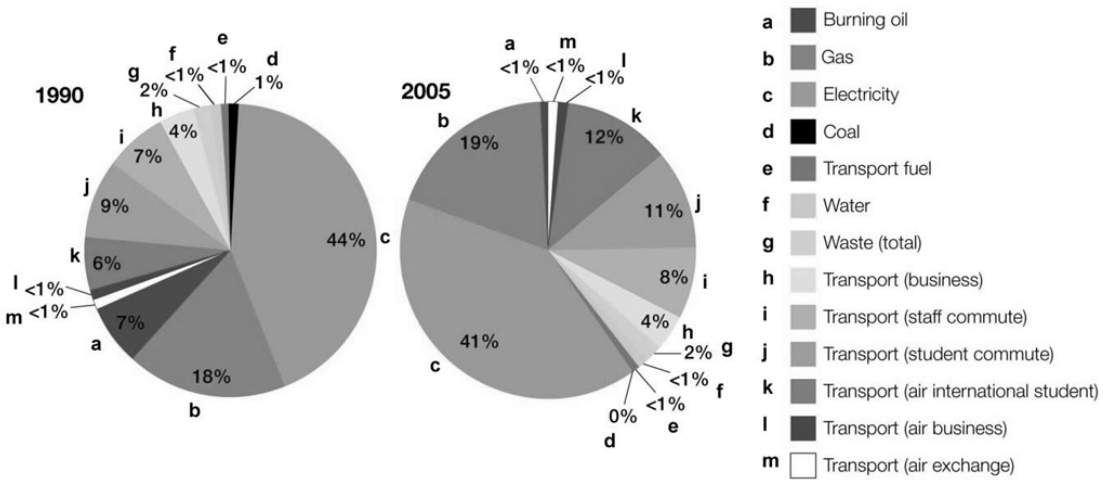
The context of the ongoing study is restricted to the UK HE sector and its ability to meet government's national and international binding targets. Worldwide, HE sector has expanded phenomenally; for example, since the 1960s, the UK HE system has expanded sixfold to >2.4 million students (Zhang et al. 2011). As a result, growth of physical infrastructure and services in the universities has led to a parallel impact on the natural environment in terms of carbon emissions. Many of the larger universities produce greenhouse gas emissions equivalent to small cities (Knuth et al. 2007).

Carbon reduction target and strategies:

The UK Government has ambitious targets to reduce greenhouse gas emissions by 80% by 2050 and 34% by 2020 against a 1990 baseline, together with 5 year carbon budgets for 2008-12, 2013-17 and 2018-2022 (Her Majesty's Stationery Office (HMSO) 2008). The HE sector is being encouraged to lead in this area as it is a significant contributor of carbon emissions in the public sector but also because of the privileged position universities occupy in being [it is hoped] centres of research excellence and cultivating 'thought leaders' for the future (HEFCE 2009). The Higher Education Funding Council for England (HEFCE) encourages Higher Education Institutions (HEIs) to adopt ambitious targets in its national carbon strategy (HEFCE 2010a). HEIs are compelled to set individual reduction targets for 2020 against a 2005 baseline for their direct and indirect emissions related to the use of fossil fuels and purchased electricity in their own buildings, stationary and mobile emission sources

(scope 1 and 2 emissions under the definitions of the GHG Protocol Corporate Standard; (HEFCE 2010b; WRI/WBSCD 2004)). Indirect emissions from procurement, business travel, and commuting among other relevant sources (scope 3 emissions) are not currently included in the targets. Figure 2 shows carbon emissions baseline during 1990 and 2005. It includes energy use within the estate (fossil fuel combustion – gas, coal, oil and electricity use), transport (institutions' own vehicle fleet, business travel and commuting), water; and waste. These results exclude procurement, which has a considerable indirect carbon impact, but the data for estimating these emissions is not readily available (HEFCE 2010a). The HE strategy requires institutions to undertake work to monitor and report these emissions, including the measurement of a baseline of procurement emissions by December 2012 and set a carbon reduction target by December 2013.

Figure 2: HE sector carbon emissions baseline – breakdown in 1990 (left) and 2005 (right)



(Source: 'Research into a carbon reduction target and strategy for Higher Education in England: a report to HEFCE' 2009)

The UK government has identified the HE sector as key to delivering carbon reduction with its Kyoto commitment and the Carbon Trust Higher Education Carbon Management programme is designed in response to this. HEFCE has produced guidance to the universities on how to produce carbon management plans which set out universities' strategic direction on carbon management. The majority of universities have carbon management plans which state their targets and strategies to manage their carbon emissions. HEFCE has also produced carbon reduction targets and strategy for the HE institutions and linked capital funding with the carbon performance of the institutions (HEFCE 2010a).

Scope 3 emissions:

HEFCE commissioned Arup, DMU and the Centre for Sustainability Accounting (CenSA) to work towards helping the UK higher education sector measure scope 3 emissions, supply chain (procurement), transport, water and waste related carbon emissions to form the part of an overall approach to reducing carbon emissions (HEFCE 2012). Good practice guidance is available for the sector which provides

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Higher Education Institutions (HEIs) with information on how to quantify scope 3 carbon emissions. It aims to help HE sector to adopt efficient and effective data collection techniques and includes examples of good practice within the sector (HEFCE 2012).The HE sector is currently dealing with a plethora of initiatives intended to reduce energy use, carbon emissions, and other environmental impacts in universities and colleges (Hopkinson and James 2007). The HEI's can also make carbon reductions through their other business activities including teaching, research and public communications. While these can be categorized as 'Scope 4' emissions and are featured in the carbon management plans but it is not possible to measure the results of these activities (HEFCE 2010a).

STRATEGIC CARBON MANAGEMENT - DMU CONTEXT

Overview of De Montfort University (DMU):

DMU is based in Leicester, England and has approximately 21,585 students, 3,995 staff, and an annual turnover of £132.5 million (Ozawa-Meida et al. 2011). DMU acknowledges that its activities have an impact upon the environment and as an organisation it remains committed to a policy of reducing carbon dioxide and other greenhouse emissions. Therefore, DMU has made a commitment to move sustainability out of the 'green ghetto' and into the mainstream culture of its organization. A key objective is that within the next ten years the university aims to make a major contribution to society's efforts to achieve environmental sustainability and become a leader in the HE sector (DMU Strategic Plan 2011).

Policies and strategies:

This section outlines DMU's own approach which seeks to explore and embed carbon management into the strategic management process through the systematic analysis of the university's strategic documents. DMU has made a strong commitment to be a sustainable university and has set a strategic direction for carbon management. DMU has a cross-faculty and departmental Sustainable Development Task Force (SDTF) that has produced a Sustainability Strategy (2009) which sets out the overall sustainable development pathway for the whole university. The Sustainability Strategy (2009) highlights the importance of measuring and monitoring environmental performance and greenhouse gas emissions to implement an ambitious carbon reduction plan. DMU has developed relevant policies and strategies in all areas of environmental and greenhouse gas emissions management including Energy Policy, Green Travel Plans, Waste Management Policy, Procurement Policy, Biodiversity Policy and Carbon Management Plan.

Consumption-based carbon footprinting:

De Montfort University is the first university in England to calculate its consumption-based carbon footprints for the effectiveness of carbon management and progress of its policies and strategies. In August 2010, the university commissioned Arup to undertake a carbon footprint assessment using a consumption-based approach. The aim of the study was to quantify the overall carbon emissions within DMU, identifying actions to make quantitative reductions in greenhouse emissions. The total consumption-based emissions for 2008/09 were estimated to be 51,080 tCO2e (metric tonnes of CO2 equivalent). Building energy, procurement and travel contribute with 33%, 38% and 29% respectively to the overall emissions in academic year 2008/09 which runs from August to July (Ozawa-Meida et al. 2011). The World Resources Institute (WRI) has divided emissions sources in three 'scopes'. Scope 1 is direct

emissions that occur from sources owned or controlled by the organisation, for example emissions from combustion in owned or controlled boilers, furnaces, vehicles; scope 2 accounts for emissions from the generation of purchased electricity consumed by the organisation; scope 3 is all other indirect emissions which are a result of the activities of the company, but occur from sources not owned or controlled by the organisation, for example, commuting and procurement. Under the classification of the WRI/WBCSD Greenhouse Gas Protocol, scope 1, 2 and 3 emissions represented 6%, 16% and 78% respectively to the overall emissions in the academic year of 2008/09. DMU study has divided its scopes' emissions into the sub-categories.

Strategic approach:

DMU has set its own target for reducing emissions from energy use and own vehicle emissions by 43% by 2020 based on its emissions in 2005/6. There are also interim targets of a 12% reduction by 2012 and 29% by 2017 in order to ensure regular monitoring and progress (DMU Carbon Management Plan 2011). The university is committed to reducing its overall carbon emissions and has developed a comprehensive carbon management plan until 2020 using a baseline year of 2005, which indicates university's strategic approach. It has designed the following strategic themes in its carbon management plan.

- Strategic approach
- Monitoring, targeting and reporting
- Policy review
- Embedding activities on carbon savings
- Strategic investment

DMU has identified a number of different carbon reduction projects relating to the strategic themes and the implementation of these projects will aim to deliver the carbon reduction targets (DMU Carbon Management Plan 2011). Progress has already been made in reducing greenhouse gas emissions from the baseline year through a mixture of changes to the university estate and space management. The university has shown very good results in environmental and sustainability benchmarking schemes (Universities that Count& People and Planet's Green League).

DISCUSSION

This paper has provided an overview of the status of current Strategic Carbon Management (SCM) research and future opportunities. It has analysed three levels of literature starting from SCM in general to the SCM in the HE sector and DMU. It has identified a need for a systematic process for a SCM in HE sector and also the lack of theoretical insights in order to understand that how this process can be implemented by the universities' senior managers. The literature reveals that there is no direct empirical knowledge on why and how organisations integrate carbon management in their strategic management process. There is a vast literature available in the form of carbon management implementation plans and strategies in the public sector but no strategic carbon management focussed academic literature was found which indicates that the field is relatively under-developed and under-researched.

The term 'Strategic Carbon Management' (SCM) is undefined so far and literature is unable to identify the difference between carbon management and strategic carbon management which is an important question for researchers to investigate. SCM is an emerging research agenda based on the literature review of this wide academic discipline. As it has been discussed, strategic management of carbon is a complex organisational task and it must begin with understanding how carbon management can affect the business. Though carbon management is a strategic issue, there remains a need for a strategic management approach to abate carbon emissions. According to the GHG Protocol (2004) the government policies will not sufficiently solve the problem of carbon emissions. Strong leadership and innovation from business is vital to making progress. The literature on SCM is very sparse and some studies have focussed on the measures to reduce carbon emissions which also include technical measures and behavioural change strategies. Efficient carbon management strategies will help decision-makers to achieve carbon reduction targets in a cost-effective manner. A SCM framework needs to be developed by all universities as a catalyst for actions against carbon emissions which can guide senior managers in how they can contribute towards carbon reduction in their decision-making.

DMU measured its carbon emissions using a consumption-based approach but there is a real need to evaluate the advantages and disadvantages of the different approaches to carbon footprinting. There is a need to carry out a study which will help in developing an understanding that how SCM can be integrated in scope 3 emissions (supply chain emissions) and support senior management to manage its overall carbon emissions. Eisenhardt (1999) explained strategy as a strategic decision-making process and therefore, the ability to make quick, widely supported, and high-quality strategic decision is the cornerstone of an effective strategy. Thus, there is a need to understand the context and the process of strategic decision-making within the institutions that how senior management makes the choices to manage its carbon emissions. Higher education provides an obvious example of applying this innovation.

CONCLUSIONS

There is a ongoing need to evaluate the process of SCM in the HE sector and to propose a clear routemap for integrating carbon management into the strategic management process. Some studies have already sought to analyze the carbon management issues within the organisations and have provided many insightful results and helpful recommendations. However it is surprising that empirical research examining the strategic approach and commitment to carbon management and strategic decision-making process within the HE organisations is relatively sparse. There is also a gap in the consideration of scope 3 emissions in the carbon management process because very few organisations are dealing with their supply chain emissions. This paper is part of a wider PhD study at DMU which aims to contribute to the debate by exploring the topic of strategic carbon management using DMU as a case study. Future research then will apply the case study research methodology to collect data using the relevant data collection tools and techniques. The evaluation and contribution to SCM knowledge in the HE sector will act as transferable best practices for other universities in an effort to lead to a breakthrough in the management of carbon through this novel strategic approach

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AN EMPIRICAL INVESTIGATION OF STRATEGIC PLANNING IN QUANTITY SURVEYING PRACTICES

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ABSTRACT

The benefit of engaging in strategic planning has been well documented over several decades of strategic management research. Despite the significant body of existing knowledge in the field, there remains a limited collection of empirically tested research pertaining to strategic planning within professional service firms (PSFs) in construction, particularly from an Irish context. The research is an exploratory study involving in-depth, semi-structured interviews and a widespread survey of Quantity Surveying (QS) practices in Ireland. The aim of the research is to ascertain the extent of strategic planning undertaken within Irish QS practices, and to gain an insight into the characteristics of the strategic planning process therein. The findings show that the strategic planning process varies within QS practices and is correlated to practice size and ownership structure. Despite the absence of a systematic process in smaller QS practices, evidence suggests that principals are thinking and acting strategically. They confirm that a more systematic strategic planning process is beginning to emerge, particularly in light of the severity of the current economic and construction sector downturn in Ireland. This paper draws on existing literature in the field, as well as research findings to propose a strategic planning process model for PSFs within construction.

Keywords: professional service firms, strategic planning, quantity surveying.

INTRODUCTION

Strategic planning is a long established function in business yet there remains limited empirical evidence to determine the process by which construction firms engage in systematic strategic planning. The limited research that has been undertaken in construction has been heavily biased in favour of large contracting firms (Hillebrandt and Cannon, 1994) and there remains a dearth of empirical evidence regarding professional service firms (PSF) operating within the industry. The extent to which strategic planning processes proposed within the general strategic planning arena are applicable to QS practices, thus remains unconfirmed. This is particularly pronounced when considered within an Irish context.

The Irish construction industry has undergone monumental change over the last decade from the peak in 2006 when construction accounted for almost 25% of GNP and 13% of total employment, to current levels of 7% and 6% respectively (DKM, 2012). Government capital expenditure, low interest rates, relaxed lending criteria and

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a deficit in housing stock were amongst the drivers that fuelled a construction boom of unprecedented proportion. The global financial crises, market uncertainty and rising national debt ultimately resulted in a bailout package from the IMF and EU worth €67.5bn and austerity measures that continue to stifle economic growth and investment in construction.

The importance of the construction industry to the Irish economy and the magnitude of the reversal of fortunes of the industry mean that now, more than ever, QS practices must engage in strategic planning to survive. This research paper addresses the perceptible gap in existing knowledge on strategic planning in QS practices in Ireland. Furthermore, it provides a framework for strategic planning in PSFs within the construction industry.

LITERATURE REVIEW

Strategic Planning

Strategic planning has been a prominent feature of strategic management theory over a prolonged period of time. The organisational benefits of engaging in strategic planning, (such as improved financial performance and increased market share) have been well documented (Brews & Purohit 2007); despite the fact that no single definition of strategic planning exists. Strategic planning is often associated with the alignment of objectives with organisational competencies in pursuit of competitive advantage. The dynamic nature of strategic planning and its varied application from one organisation to the next results in differing process characteristics between firms.

The strategic planning process is multifaceted and requires consideration of a number of variables including:

- the ***formality*** of the strategic plan as well as the formality of the process
- planning ***time horizon***
- the ***approach*** to strategy: planned, emergent or resource based (Mintzberg, 2003)
- ***organisational type***: prospector, analyser, defender, reactor (Miles & Snow, 1978)
- the ***industry environment*** within which the firm is operating (Grant, 2003).

Furthermore, characteristics of the process itself should be considered, including dimensions such as:

- ***strategic planning comprehensiveness***: the exhaustiveness of information gathering in informing decision making (Fredrickson & Mitchell, 1984)
- the extent of ***participation*** in the process across levels of the organisation (Dyson & Foster, 1982)
- the ***flow*** of initiatives – be it top down or bottom up
- the use of ***strategic planning tools***

Given the complexity of the process, the use of strategic planning process models is commonplace to provide a framework within which to consider the numerous variables. Several strategic planning models have been developed, which outline the need to determine organisational objectives and analyse the environment within which the firm is operating prior to a generic strategy being chosen (Porter, 1980). Firms

operating within a turbulent environment in particular, must ensure that the resulting strategy and strategic plan has sufficient flexibility to enable the firm to respond to the changing requirements of the industry within which they are competing (Grant, 2003). Once again, seldom have existing models been empirically tested on the construction industry, not least PSFs within it.

Strategic Planning in Quantity Surveying (QS) Practices

Strategic planning research in construction is heavily weighted towards contracting organisations (Betts and Ofori, 1992; Dansoh, 2005) rather than the professions, including QS practices (Jennings and Betts, 1996). Additionally, significant emphasis is placed on project planning and management within construction rather than organisational or strategic planning (Phua, 2006). However a longitudinal study undertaken by Boon (2008) on QS practices in New Zealand (reported within this forum), has provided some insight into the management of a small number of QS practices in New Zealand, along dimensions of market orientation, knowledge base, cost structure, price competitiveness and financial resources.

Limited as construction strategic planning research is, there are opposing views regarding the prevalence of strategic planning within the industry. On the one hand Betts and Offori (1992) suggest there is a "*dominant structural shift in the emphasis of business planning from the tactical to the strategic*" (pp. 513) whereas Hillebrandt and Cannon (1994) argue that there is a lack of strategic planning in construction firms in the UK because it is not necessary to plan for large investments in fixed assets. Until now, this has not been confirmed within an Irish context.

RESEARCH METHODOLOGY

The research reported forms part of a wider investigation of strategic planning within Irish QS practices, and was undertaken in two stages.

Stage 1:

Semi-structured interviews were conducted with the Managing Director/Partner within ten QS practices. A selective sample based on known information pertaining to company size was used to ensure practices of varying sizes were included in the sample.

Interview questions were developed (and pilot tested) in advance of the interviews addressing the key dimensions and characteristics of the strategic planning process identified in the literature. Table 1 presents an overview of the main topics addressed.

Table 1 Questionnaire Content

***Questionnaire section h*eading**	***Issues addressed within section***
General Company Information	Position held by respondent, ownership structure, sectors serviced, services provided, number of employees
Generic Strategy	Strategic type, approach, environmental analysis, corporate and business strategy
Strategic Planning Characteristics	Formality, written plan, participation, flow, planning time horizon, content, constraints on the strategic planning process

The semi-structured interviews allowed flexibility in the sequence of questions and depth of discussion of pertinent issues raised. The initial stage provided a considerable insight into the strategic planning processes of the practices, and also served to inform the second stage of research.

Stage 2:

A small research grant was made available by the Society of Chartered Surveyors Ireland (SCSI) to undertake a widespread investigation of strategic planning within members of the QS Division of the Society. Questions were informed by an extensive literature review and by insights gained in stage one. The questionnaire contained similar headings to those outlined in Table 1. The final sample size was 150 and a response rate of 41% was achieved. Phase one participants were involved in the second phase, and are included in the total above. This served to triangulate findings from the initial stage.

FINDINGS AND ANALYSIS

General Company Information

Demographic information on participating firms was confirmed as follows:

- 85% of practices are independently owned. The remainder are part of an international organisation
- 79% have been operational over 5 years; with 66% over 10 years
- 66% have five or fewer employees, with only 1 respondent having greater than 100 (these figures were 41% and 2 respectively at peak, 2007)
- 39% are ISO certified

Strategic Planning Characteristics

The overwhelming majority of QS practices do not have a formal strategic planning process, nor do they have a written strategic plan, which differs from the findings of, for example, Dansoh (2005) within QS practices in Ghana. Of the third that do have a formal process and written plan, the practice is part of a larger construction

consultancy group and has a time horizon of 3 years, which concurs with Dansoh (2005) findings. The approach to strategy is planned, involves considerable analysis of the internal and external environment and participation of staff at various levels within the organisation is apparent. The strategic planning process across the majority of respondent practices is however, unstructured and undocumented, with a top down flow and limited participation, which is similar to conclusions drawn by Price et al. (2003) within the UK construction sector.

Regardless of the existence of a formal plan, internal organisation, industry and economic analysis are prevalent while a notable lack of competitor analysis is undertaken across the board. While this represents a divergence from the general strategic planning literature, it corresponds with the findings of Price et al. (2003). Limited information pertaining to competitor behaviour, and a concentration on the client (rather than competition), may go some way to explaining the divergence. The importance of client retention and repeat business cannot be over stated in the context of PSFs, as noted by Maister (2003) when he puts forward that:

> "*Most professional firms say that their existing clients represent the most probable (and often the most profitable) source of new business*." (pp.97)

Without exception, respondents stressed the importance and reliance upon repeat business which coincides with the above observation. Furthermore, emphasis is placed on the internal capabilities and competencies of the practice to ensure that the practice reputation affords the opportunity of securing repeat business, as well as referral business (through word of mouth). This forms a crucial component of the strategic decision making process within QS practices, which concurs with the findings within PSFs across other sectors (Maister, 2005).

As regards generic strategy being pursued, the overriding strategy amongst QS practices is currently stability (or survival). Significant proportions are pursing a combination strategy of domestic stability together with international expansion. The exceptional economic and industry environment conditions must be borne in mind when considering this finding, which could usefully be revisited periodically to gain deeper insight. Many practices had already retrenched when fieldwork for the research was undertaken therefore it was noted in the minority of cases.

Patterns in the strategic planning process amongst respondents reveal that strategic planning process characteristics differ between QS practices depending on size and ownership structure. Practices that are subsidiaries of larger international construction organisations tend to have a formal, structured process for strategy development driven primarily by head office requirements. The positive relationship between practice size and strategic formality has previously been noted within the construction sector in the UK (Price et al., 2003) and Ghana (Dansoh, 2005). Indigenous practices, on the other hand, currently tend to have an informal/ad hoc approach to strategic decision making, which is driven by the principal and seldom results in a written plan.

The turbulent economic and industry environment has resulted in increasing industry, economic and internal analysis being undertaken. However, as noted by Hillebrandt and Cannon (1994) in UK construction firms, evidence within Irish QS practices indicates that principals are thinking and acting strategically, but not necessarily in a

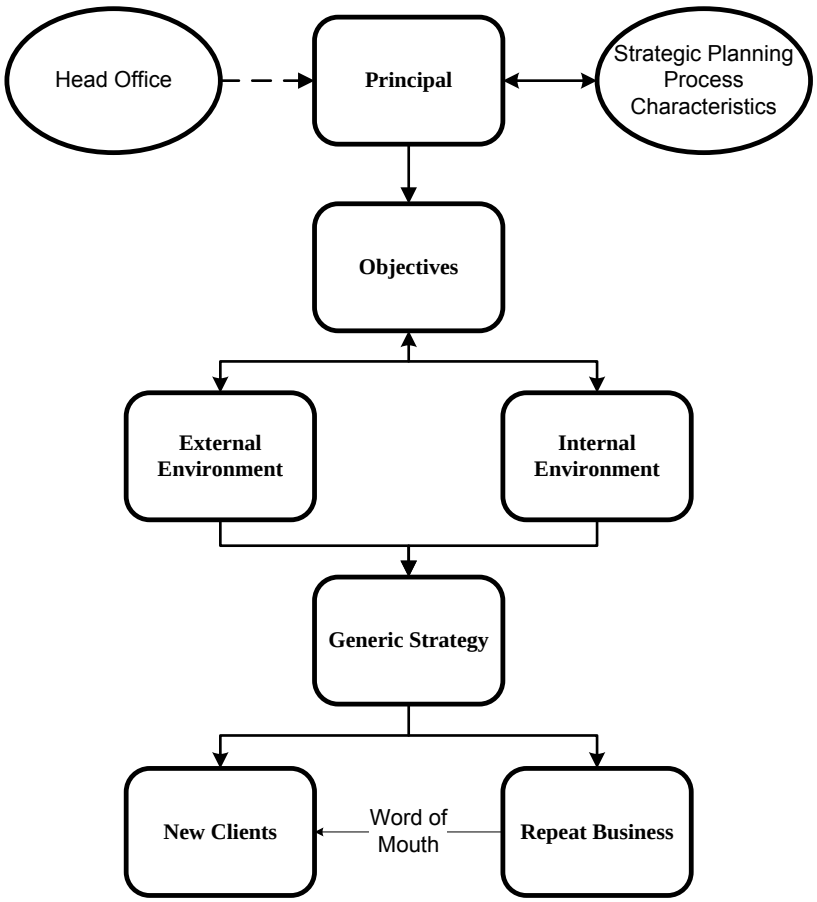
systematic way. Crucially however, nearly half of the respondents currently without a systematic strategic planning process (hence plan), noted that strategic planning processes are beginning to emerge.

The research reported confirms that strategic planning is being successfully implemented in QS practices, most notably those that form part of an international construction organisation. Within these practices there is a convergence with the strategic planning literature as regards formality, approach, participation and the use of strategic planning tools to facilitate the process but a divergence is evident in the lack of competitor analysis undertaken. However, practices that systematically engage in the process tend to be large firms, which constitute the minority of QS practices in Ireland. Given the growing recognition of the need to engage in strategic planning, particularly in light of uncertainty and intense competition within the sector, an opportunity now exists to model the process for more widespread application.

Modelling Strategic Planning for QS Practices

The strategic planning process will not be identical in every organisation. The multifarious nature of the process thus warrants the use of a model to act as a framework of analysis of existing strategic planning practices, and guide the formulation of a new strategic plan. Resulting from the empirical investigation reported, a model of strategic planning was developed and is presented in figure 1.

Figure 1: Strategic Planning Process Model



Strategic planning in QS practices is primarily driven by the principal, save for subsidiary organisations, where initiatives are driven by head office. The approach and strategic type play a critical role in this regard in determining process characteristics such as process formality, plan formality, scope of participation, planning time horizon and use of strategic planning tools. Head office and process characteristics vary between groups and are important influences in shaping the process. Other components of the model are applicable across all practices, regardless of formality of the process or existence of a written plan.

Organisational objectives are developed based on the internal environment and competencies (staff, marketing, finance, IT, quality) as well as the external environment (macroeconomy, construction sector, professional body standards) prior to the determination of the generic strategy in pursuit of objectives. In quest of competitive advantage, the generic strategy signifies the mechanism by which new clients will be sought and also how new business is generated with existing clients. Within PSFs, and specifically QS practices, a major source of new client business is achieved through word of mouth, thus the reputation of the practice is crucial in pursuit of competitive advantage. The dynamic nature of construction is such that the external and internal environments must be constantly monitored thus a two way flow between organisational objectives and environmental analysis is evident.

CONCLUSIONS

The results of this study demonstrate that Irish QS practice principals are thinking and acting strategically, yet often no systematic strategic planning process is evident. With the severity of the economic and construction industry crises, increased competition and demanding clients, the need for systematic strategic planning has never been more critical. Recognition of the role of strategic planning in QS practices is emerging.

The multi-faceted nature of strategic planning results in a complex process which is exacerbated in the context of a turbulent environment such as the construction sector. The process does not, however, need to be cumbersome or rigid, nor does it require the recruitment of external consultants. Strategic planning must be systematic, participative, ongoing and realistic, yet remain flexible to allow for changes within the industry and competitive environment. The use of the model presented may act as a framework within which to consider the components of the process. Participation from staff is crucial for idea generation, as well as instilling a sense of ownership of the strategy. This is particularly important for PSFs, whereby staff interaction with clients cultivates the reputation upon which repeat business depends. The education and training of a QS in project and risk management must now be transferred from the tactical (project level) to the strategic, in order to better position QS practices for recovery.

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AUSTRALIAN CARBON CALCULATOR INITIATIVES: FUEL CONSUMPTION AS A PROXY FOR MASS-HAUL GREENHOUSE GAS EMISSION DURING ROAD CONSTRUCTION

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ABSTRACT

Australian state transport authorities are required to support Australian Kyoto Protocol commitments through investment in methods of reducing greenhouse gas emissions. Most states have involved themselves in development of carbon calculators to be used in all phases of road construction, operations and maintenance. The initiatives include the Greenhouse Gas Assessment Workbook developed by a group of transport authorities an extension of the Workbook, Carbon Gage developed by VicRoads. Analysis of the calculators provides evidence of an unarticulated general acceptance of fuel consumption as a proxy for emissions. At the same time analysing the Australian and international carbon calculators for specific and detailed mass-haul parameters illustrates the uncertainty concerning the accuracy of calculator methodologies and measures produced to-date.

Keywords: Australia, GHGE proxy, carbon calculator, fuel consumption, mass-haul.

INTRODUCTION

As part of its commitment to the Kyoto Protocol, Australia plans to reduce greenhouse gas emissions (GHGE) by at least 5% below 2000 levels by 2020. Construction of infrastructure has been identified as a major contributor of GHGE and government transport agencies at all levels have invested in development of reduction options. Although much research has been conducted concerning vehicle travel on completed roads, little research has focused on negative environmental impacts during construction. The balance of this paper reports on the initial stages of an Australian multi-stage research project studying the effects of mass-haul GHGE during infrastructure construction. This report is based on a desktop search of Australian government documents, international GHGE inventory reports, global emissions

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calculators related to infrastructure construction and a range of relevant academic literatures on mass-haul in relation to a sustainable built environment.

All states in Australia are designing processes to support the Commonwealth government commitment to reduce GHGE. One specific area of progress is for infrastructure construction. The total value of road construction in Australia for 2010-11financial year was $AU16.2 billion, comprised of $AU5.2 billion from the private sector and $AU11 billion from the public sector (Australian Bureau of Statistics 2012). The six state government transport authorities have the responsibility for building major roads. These transport authorities also have oversight of environmental impacts during both the construction and the operation phases of transportation systems. Currently, the two most populated states, Victoria and New South Wales (NSW), have progressed from developing sustainability policy to the development of tools and processes to assist in the reduction of GHGE during infrastructure construction.

Victoria appears to be the most advanced Australian state in translating greenhouse reduction policies into action. The state transport authority, VicRoads, introduced a voluntary sustainability rating tool, INVEST (Integrated VicRoads Environmental Sustainability Tool) in March 2011. Greenhouse gas monitoring of road construction activities is one of the prerequisites to participating in the INVEST rating program, whereby the contractor must have a system for recording site use of fuel, quantities and types of materials, energy and waste generated. The collected data is then used to calculate a greenhouse gas footprint of the road construction project (VicRoads 2011). In order to quantify GHGE, VicRoads has also developed a spreadsheet based calculator called Carbon Gauge, which calculates the whole-of-life environmental impacts for road construction, operation and maintenance.

In alignment with the NSW Government Sustainability Policy, NSW Roads and Maritime Services has a commitment to becoming carbon neutral by 2020. This goal takes into account current road life-cycle estimates of CO_2e. Road construction is projected to generate approximately 461,000 tonnes of CO_2e for the 2012-13 period, while maintenance activities are projected to produce 256,000 tonnes of CO_2e for the same period Operation activities are estimated to produce 165,000 tonnes of CO_2e per year from November 2011 onwards (NSW Roads and Maritime Services 2011).

If these estimates are accurate, it would mean that construction of roads, not road operation and maintenance, would account for the majority (52%) of emissions. In terms of reducing greenhouse gas emissions from mass haul operations, NSW and South Australia are process leaders. Currently, these two states also require earthworks plans to be submitted as part of the tendering process for major construction. This mandatory requirement promotes the planning of efficient, feasible and optimised mass-haul which would result in lower GHGE due to a reduced consumption of fuel.

GREENHOUSE GAS EMISSIONS

In general, emissions are calculated using emission factors (EFs) and associated activity (A) information. Emission factors indicate the mass of pollutant emissions released per unit of the associated process variable. Activity information refers to the process variable, such as mass of fuel consumed or output produced. The emissions (E) are then calculated as:

$$E = EF \times A \quad \text{(Miller et al. 2006)}$$

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The three greenhouse gases which are relevant to fuel combustion are carbon dioxide (CO_2), nitrous oxide (N_2O) and methane (CH_4). According to the IPCC, CO_2 emission factors for fuels are generally well determined within ±5%, as they are primarily dependent on the carbon content of the fuel. As for non-CO_2 emissions, however, the uncertainty of the CH_4 emission factor may be as a high as a factor of two while the uncertainty of the N_2O emission factor may be an order of magnitude, i.e. a factor of 10 (IPCC 2000). Methane (CH_4) emissions in petrol and diesel vehicles vary with the use of catalytic converters. The use of post-combustion control reduces methane emissions. Nitrous oxide (N_2O) emissions from motor vehicles arise primarily as a result of catalysts in road vehicles, as N_2O emissions are a by-product of the catalysts' removal of oxides of nitrogen (NO_x) (Beer et al. 2002).

According to Caterpillar suppliers in Australia, most earthmoving vehicles available in the Australian market do not have catalytic control devices installed, but some machines are now starting to be supplied with Tier 4 emission control devices. Tier 4 emission standards were introduced by the US EPA in 2004 (to be phased in during 2008-2015), and require the emissions of particulate matter and NO_x from non-road engines to be reduced by 90%. The US EPA also introduced regulations on sulphur content (15ppm) in non-road diesel fuels to enable sulphur-sensitive catalytic control technologies for Tier 4 (Dieselnet 2012). However, even with computerised vehicles able to provide accurate consumption of fuel, calculating emissions is not without problems. Uncertainty in the calculated emissions can be classified as scientific uncertainty (for example, uncertainty in Global Warming Potentials), model uncertainty (associated with the mathematical equations used to characterize the relationships between various parameters and emission processes), or parameter uncertainty (associated with quantifying the parameters used as inputs, e.g. activity data, emission factors, or other parameters) (World Resources Institute 2003). However levels of uncertainty have not deterred governments and industry from cooperating in the development of tools and methodologies to reduce the negative environmental impact of GHGE created during the construction of major works.

GREENHOUSE GAS CALCULATORS FOR MASS-HAUL

Construction of roads is usually considered as a 'macro process' in discussions related to environmental impact. However, if the estimate by RMS that over half of future carbon dioxide emissions (CO_2e) will be generated during the construction phase is accurate, then a closer consideration of the construction process could provide new methods of reducing total GHGE. One road construction 'micro-process', earthworks or mass-haul operations, has been identified as an area which has significant potential for the reduction of GHGE (Kenley et al. 2011). Earthworks are a significant part of major road projects, accounting for as much as 35% of the total construction cost according to industry sources. Haulage of soil and rock from cut to fill sites results in GHGE from the combustion of diesel, which can be highly variable depending on the efficiency of contractor practices. Thus, concentrating on the emissions from the fuel used during construction specifically related to earthworks could provide an opportunity for reducing total GHGE.

Governmental support for Kyoto has produced a global search of methods to reduce greenhouse gases. This desktop search has found a number of different types of 'carbon calculator' that include mass-haul activities. The early form appeared as spreadsheets, such as the Roadway Construction Emissions Model (2009) developed by Sacramento Metropolitan Air Quality Management District and the Environment

Agency's Carbon Calculator for Construction Activities (2007 & 2010) designed and improved by the Environment Agency, UK.

Table 1: Sample of Greenhouse Gas Calculator Software

Earthworks Parameters	Outputs	Functionality
Changer (GHG Calculator)	**International Road Federation (IRF) 2010**	**http://www.irfghg.org/ [accessed 15 May 2012]**
Clearing and piling per unit of road surface Mass haul operations Site electricity and fuel Pavement materials Materials transport Equipment: hours per type	CO2 equivalent emission (MMTCO2Eq)	Developed GHGE from road construction projects Pre-construction, Pavement modules Report generation: Excel, Word and HTML IPCC guideline compatible
URBEMIS 9.2.4 2007 (Software for Windows)	**South Coast Air Quality Management District USA 2007**	**www.URBEMIS.com [accessed 15 May 2012]**
Construction data for 7 differences: type start date, end date, work days/week, equipment details, area covered and quantities of work, equipment load factors Area source data Operational data	GHG emissions and fugitive dust for the whole project (including on-road and off-road vehicle emissions) and for each construction phase	Calculates air emissions from land use sources Uses California Air Resources Board's EMFAC2007 model for on-road vehicle emissions Uses OFFROAD2007 model for off-road vehicle emissions. Customise measures Report generation: Excel and PDF
CalEEMod 2011.1.1 Software-California Emissions Estimator Model	**South Coast Air Quality Management District USA 2011**	**http://www.caleemod.com/ [accessed 15 May 2012]**
Project location, land & size, operational year, utility information, construction schedule, phases and times, equipment type, horsepower, percent mitigation, equipment and vehicle numbers (On-road & off-road), activity hours, amount of mass hauled, trip rates, lengths, percent trip type, energy, water and wastewater use	Quantifies direct emissions (including fugitive dust, carbon dioxide, methane and nitrous oxide) from construction and operation (including vehicle use), as well as indirect emissions, from energy use	Uniform platform for government agencies, land use planners, and environmental professionals Incorporates Pavley and Low Carbon Fuel standards Calculates customised probable GHGE and benefits for California Customisation: vehicle classes for hauling Report generation: Excel or PDF

The second round of development has resulted in software options. Table 1 provides a sample of currently available internationally developed software that can be used for GHGE calculations in relation to earthworks/mass-haul. The earthwork parameters vary but mostly include fleet information, scheduling data and a mixture of on-site and off-site haulage information. The functionality claimed of course depends on user capability. As would be expected the products use data from previous projects to generate estimated future emissions. Data sources are location specific which may mean that a universal tool is not as effective as one developed taking into account local conditions. (Two other software products have been mentioned in relation to

GHGE calculation and mass-haul but no internet presence was found for JouleSave a plugin for MXROAD and Arup CO2ST Tool).

The Australian Contribution

Agreeing on standardisation of greenhouse gas calculations amongst countries, states or industries is problematic. It is a difficult task to define boundaries and agree on parameters for calculations to ensure fair comparison when local laws, practices and environmental limitation must be taken into account. Daviet (2006) notes the most important step in designing an industry-specific tool for calculating GHGE is to engage stakeholders in a transparent and inclusive approach. The argument for engagement is that stakeholders involved in the development of a tool or methodology are more likely to champion adoption. This approach assisted the Australia and New Zealand Transport Authorities Greenhouse Group (TAGG) in the development of a standard greenhouse gas calculation method for road projects in both countries. Joining New Zealand, the Australian member states include: Victoria, New South Wales, South Australia, Western Australia and Tasmania (one state and the two territories are absent from the group).

TAGG published the Greenhouse Gas Assessment Workbook for Road Projects in June 2011 (Dilger et al. 2011b). The Workbook contains quantification methods designed to be compatible with the Greenhouse Gas Protocol Corporate Standard, consistent with methods recommended by IPCC (2000) for the compilation of emissions at the national level. The standard is linked to the six greenhouse gases named in the Kyoto Protocol: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6). The link to the international movement for consideration of climate change is important for meeting Kyoto targets nationally although, the TAGG Workbook authors indicate "road projects will typically only result in emissions of carbon dioxide". The Workbook is considered to be both a means of calculating estimated GHGE and learning how these emissions could be reduced. In addition, the Workbook is expected to support comparison of projects to develop benchmarking greenhouse gas reduction best practice between Australia and New Zealand projects.

The TAGG Workbook methodology currently involves the use of default quantity factors which are assumed values for project variables. These construction project variables are specifically related to earthwork and fuel usage, e.g. default quantity factors listed in the Workbook include: cut to fill diesel use of 1 L per m^3, cut to spoil diesel use of 4 L per m^3, import and placement of fill diesel use of 3.5 L per m^3, and strip and respread of topsoil diesel use of 1.2 L per m^3. In the absence of material quantities, the default quantity factors to be used would be: grader fuel use of 5.1 kL per month, wheeled loader fuel use of 4.5 kL per month, and scraper fuel use of 14.5 kL per month (Dilger et al. 2011b). The majority of the default quantity factors were extracted from the Greenhouse Gas Assessment Tool developed by the South Australian Department of Transport, Energy and Infrastructure for use by cost estimators, including default quantity factors for demolition and earthworks (Dilger et al. 2011a). The Carbon Gauge greenhouse gas calculation tool developed for VicRoads is based on the TAGG methodology, and contains the same default quantity factors for the calculation of emissions. These assumptions for fuel consumption values per unit of material to be moved are used within the calculator without explicitly stating the haul distances or other conditions for which they are appropriate.

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FUEL CONSUMPTION AS A PROXY FOR GHGE

Hughes et al. (2011) claim that there are two approaches to calculation of CO_2e for mass-haul during linear infrastructure construction. They suggest that the current 'top-down' practice of using pre-determined coefficients based on a database of historical data (Hammond and Jones 2008) could provide inaccurate and potentially costly estimates. They suggest using a 'bottom-up' approach that provides a project specific assessment of fleet and quantities based on site specifications. The bottom-up approach estimates the number of hours of equipment use from the amount of material to be moved. The hours of equipment use are converted to fuel consumption and fuel consumption is used to calculate the associated emissions. According to Hughes et al. (2011), standardised carbon dioxide values for earthworks operations are frequently not representative and calculating based on specific project variables such as ground conditions, haulage distances and quantities provides more accurate mass-haul CO_2e.

Regardless of the methodology used to calculate GHGE for mass-haul or the accuracy of such estimates, all calculators appear to agree that the use of fuel consumption data (or an estimate of fuel consumption) in earthworks operations is the most direct, robust, convenient and economical method available for calculating emissions because:

1. **GHGE are highly proportional to the amount of fuel combusted** as the majority of the emissions are CO_2e formed from the combustion of carbon contained within the fuel, while N_2O emissions which usually arise from oxidation of NO_x are not as prevalent in earthmoving vehicles in Australia. The majority of Australian earthmoving equipment is not equipped with oxidation catalysts resulting in nitrous oxide emissions through oxidation of NO_x. CH_4 emissions form a relatively small component of total emissions (in terms of CO_2 equivalents).
2. **Using fuel consumption data does not require additional measuring devices** which may be too expensive to be installed and maintained on a wide-scale basis.
3. **Fuel consumption data is convenient to collect** as it is usually available through invoices.
4. **Other methods of estimating emissions rely on engine specific data or statistical data** that would not be applicable to Australian vehicles, and would therefore be inaccurate.

CONCLUSION

Australian state transport authorities are part of a global effort to reduce greenhouse gas emissions. The results of this engagement are the TAGG Workbook to reduce project GHGE and the whole-life products, INVEST and Carbone Gage developed by VicRoads. This paper provides a first report of a major Australian study concerned with developing a methodology for reducing greenhouse gas emission from mass-haul activities during infrastructure construction (Kenley et al. 2011). The initial desktop document analysis and exploration of international carbon calculators has provided verification that measuring greenhouse gas emission is complex and difficult to standardise. The range of public and private carbon calculators that have been developed provides evidence of the extensive number of factors which affect calculation of negative environmental emissions. Whether or not calculations are considered for the total lifecycle of road construction or focused on the micro-process of mass-haul during construction the complexity of activities, fleet, and materials

means that measurement methodologies are still at the incubation stage. Therefore all present attempts of calculating actual GHGE will for the present need to rely on using fuel consumption as a proxy for GHGE despite uncertainty concerning the accuracy of these figures.

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CARBON REVIEW AND QUALITATIVE COMPARISON OF SELECTED CARBON COUNTING TOOLS

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ABSTRACT

Climate change is one of the greatest environmental threats facing our civilization today. In the UK, carbon related to buildings amount to around half of the total greenhouse gas emissions. It is essential that we are able to accurately count carbon which is now increasingly being used as a metric of building environmental performance and energy efficiency. Following the rule that only measurable is manageable, quantifying carbon will serve as a basis for building environmental management and improvement. The aim of this paper is thus to review the concept of whole-life carbon in buildings and the different carbon estimating tools available. The research revealed that the total (whole-life) carbon emissions associated with a building from cradle-to-grave can be categorised into embodied and operational carbon. Whilst there are now formalised methods for measuring operational carbon due to its significance in whole-life carbon, there is still less emphasis on embodied carbon counting despite the rising need and importance. Qualitative comparison of some selected open source UK tools for embodied carbon estimation shows disparities in boundary definitions, unit of measurements and methodological calculations amongst others. These suggest that an industry agreed data structure and common methodology is needed for embodied carbon estimation.

Keywords: building environmental performance, carbon counting tools, climate change, embodied and operational carbon, greenhouse gases.

INTRODUCTION

Climate change is one of the greatest environmental threats facing our civilization today (Ürge-Vorsatz & Novikova, 2008; Kenny *et al.*, 2010). Carbon related to buildings amount to around 47% of the total greenhouse gas emissions causing climate change in the UK (BIS, 2010). It is essential that we are able to accurately count carbon which is one of the worst contributors to these greenhouse gases to reduce the devastating impact of the increasing concentration of greenhouse gas emissions on the environment (Grant *et al.*, 2009). The design process can greatly benefit from accurate carbon counting as it will reveal the carbon implications in units of the various design options and decisions made at the early stages of a development.

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This will in turn help to maximise potential for reduction and facilitate opportunities for environmental improvement (Lowe, 2000; Atkinson *et al.*, 2009).

Carbon emissions are now being used as a benchmark for building environmental performance in the UK construction industry (Hammond & Jones, 2008a; Anderson *et al.*, 2009) and in direct response to the Energy Performance in Buildings Directive, 2002 and current UK Building regulations Approved Document Part L, 2006 (BIS, 2010). Similarly, around the world particularly in advanced economies, carbon is increasingly seen as a metric of environmental performance and energy efficiency (Pandey *et al.*, 2010; Mah *et al.*, 2011; RS Means, 2011). Carbon taxation, carbon reduction commitments and off-setting continue to propel the increasing significance of counting carbon. For example, the EU Emissions Trading Scheme (ETS) was founded to regulate carbon emissions, and the UK power prices now include carbon component (Voorspools, 2006). It thus means that carbon emissions now have monetary cost attached to its environmental implications and this is changing the culture in the industry towards environmental awareness and carbon accountability.

With the invention of the Climate Change Act 2008, it is now a legal obligation in the UK to reduce carbon and different targets have been set to enhance this commitment. Compared with the 1990 baseline, 26% reduction is expected by 2020 and no less than 80% by 2050 according to the recent government reports (DECC *et al.*, 2008; BIS, 2010). This obligation continues to be driven by the UK Government, EU regulations and corporate social responsibility in the private sector (BIS, 2010). Specifically, in the UK, a range of tax, levy, incentives and market mechanisms have been put in place to support this obligatory commitment of reducing carbon and other greenhouse gases (Pellegrini-Masini *et al.*, 2010; Monahan & Powell, 2011).

To combat climate change, carbon accountability and management will serve as a basis for building environmental performance and can help to promote environmental aware buildings (Pandey *et al.*, 2010; Mah *et al.*, 2011). To evaluate the environmental implications of a product the carbon impact resulting from each stage of its life cycle must be accounted for (Hammond & Jones, 2008a). Carbon counting can help to determine what and where significant carbon emissions are being produced during the life cycle of an asset to enable appropriate mitigating measures in a cost effective way at the initial phases of the design process (Sturgis & Roberts, 2010). Consequently, there have been several attempts globally to develop tools for quantifying these carbon emissions. The aim of this paper is to review whole-life carbon emissions associated with a building and the currently available carbon estimating tools. It further explores the consistency of selected open source UK embodied carbon counting tools using a qualitative comparison.

WHOLE-LIFE BUILDING CARBON FOOTPRINT

Different authors have diverse views of what whole-life carbon represents. Pandey *et al*. (2010) are of the opinion that the carbon footprint of a product throughout its life-cycle includes the carbon content from manufacture through to distribution, consumption/use and disposal. The carbon footprint associated with the different stages of a product entire life-cycle otherwise known as cradle-to-grave can either be direct or embodied emissions (Pandey *et al.*, 2010). Roche & Campanella (2010) simply refers to the carbon content associated with a product from cradle-to-grave as carbon emissions. The UK Building Cost Blackbook classified carbon footprint as either embodied or direct carbon (Franklin and Andrews, 2010) whilst embodied and operational carbon were the terms used by Hammond & Jones (2008a).

Indeed, the use of the terms may be different from one author to the other but it appears that the fundamental principles remain the same. Sturgis & Roberts (2010) gave a definitive explanation of carbon footprint associated with a building life cycle. They stated categorically that the total (whole-life) carbon emissions in a building include both embodied and operational carbon. Notably, several other research in this field agree with this classification and concept (Shipworth, 2002; Hammond & Jones, 2008b; Anderson *et al.*, 2009; Pandey *et al.*, 2010). The subsequent sections explain the operational and embodied carbon emissions associated with a building life cycle.

Operational carbon

Operational carbon emissions which are the emissions generated from the activities of the building users as a result of lighting, electricity, heating and cooling contribute a staggering 70% to the total carbon emissions associated with a building (BIS, 2010; Sturgis & Roberts, 2010).. There have been considerable measures taken by the industry, government and even individuals to reduce these emissions. The UK government on their part has developed legislation such as Part L of the Building Regulations and the quantification of operational carbon emissions of buildings is now achieved by various standard assessment methods such as Energy Performance Certificates (EPCs) and Display Energy Certificate (DECs) (Sturgis & Roberts, 2010).

In different parts of the world, there are standard published sources available that provide the emission factors for each energy supply for converting the operational energy usage in a building into carbon emissions (Pandey *et al.*, 2010). The actual total energy usage of an existing building can be read from a meter whilst for a proposed building, different energy modelling software such as HEED (Home Energy Efficient Design), Design Builder, etc. are available in the industry for deriving an estimate (Roche & Campanella, 2010). Carbon emissions resulting from operational energy usage in UK buildings can be calculated using the emission factors indicated in DEC methodology published by DEFRA (BIS, 2010). Also, there are many carbon footprint calculators being developed in the industry for this purpose and to raise environmental awareness such as Act on CO2, Carbon footprint calculators, etc.

Embodied carbon

Embodied carbon emissions contribute approximately 30% of total carbon emissions from buildings over its entire life although it could be more or less depending on building types (BIS, 2010). Embodied carbon measurement has not received sufficient attention in terms of government legislation and currently has no standard assessment methodology (Sturgis & Roberts, 2010). Hammond & Jones (2008b) defined embodied carbon of building materials as the total carbon released over its life-cycle. According to Franklin and Andrews (2010) it is the total carbon emissions as a result of total primary energy consumed during the life-time of a product. It thus implies that the embodied carbon associated with a building can be categorised into various boundaries. Interestingly, there is a common agreement in the industry as to the definition of these boundaries in respect of embodied carbon calculation (Hammond & Jones, 2008a, 2008b; Anderson *et al.*, 2009; Franklin and Andrews, 2010). The system boundaries of a product, which is the point in the product life-cycle (or life-time) that embodied carbon could be counted, are analysed below.

Cradle-to-Gate (all carbon emitted or released until the product leaves the factory gate); **Cradle-to-Site** (includes all carbon emitted until the product has reached the point of use which is the building site); **Cradle-to-End of construction** (carbon emitted

in cradle-to-site plus emissions as a result of assembly on site and construction activities); **Cradle-to-Grave** (all carbon emitted from the extraction of raw materials until the end of the products lifetime including maintenance and final disposal); **Cradle-to-Cradle** (applies only to recycled materials as it also includes element of recycling). This last is not yet a commonly used system boundary due to the many complications and uncertainties with recycled materials (Hammond & Jones, 2008b).

CARBON COUNTING TOOLS

Carbon counting is quantifying in units the carbon impact of a product. The carbon footprint of a building over its life-cycle is divided mainly into two phases namely construction phase and operational phase (Sturgis & Roberts, 2010). Fieldson *et al.* (2009) concluded that there are many carbon counting tools available in the market but most of them are not suitable for providing the level of carbon information details required in construction. Whilst most carbon counting tools offer the possibility for determining carbon emissions as a result of operational energy use in a building and from transportation, fewer tools can provide embodied carbon emissions associated with construction processes and activities (Roche & Campanella, 2010). Roche & Campanella (2010) suggested that carbon counting tools can be divided into different classifications based on the type of carbon information they provide. These carbon counting tools and the type of information they produce are discussed below under the two classifications commonly referred to by the various authors in this area.

Firstly, carbon footprint calculators are mostly freely available online to determine personal carbon emissions from home like electricity and gas usage, food, water, waste, transportation and the likes. There are countless example of these tools available worldwide and they include: Liveclimate, American Forests, Greenhouse gas calculator, Best Foot Forward, BP calculator, California Carbon calculator, Chuck Wright, Clear Water, EPA Personal Emissions calculator, Safeclimate, etc. Some of these tools even provide opportunity to buy carbon offsets, which involves investing in renewable technologies to balance energy usage (Pandey *et al.*, 2010). The reliability of these carbon footprint calculators is however questionable as most of them will produce different results with similar inputs (Roche & Campanella, 2010).

Secondly, carbon estimators and calculators are for estimating embodied carbon emissions in buildings such as carbon emissions associated with construction processes and building maintenance (Hammond & Jones, 2008b; Jones, 2009). They are seldom freely available online (Mah *et al.*, 2011). Many of the carbon estimators and calculators currently available in the industry are mostly for in-house use (Roche & Campanella, 2010). Examples of carbon estimators include Build Carbon Neutral Construction Calculator, Athena: EcoCalculator for Assemblies, Construction carbon calculator, etc. Examples of publicly available carbon estimators and calculators in the UK include CapIT and UK Building Blackbook (Franklin and Andrews, 2010), BRE Green Guide (Anderson *et al.*, 2009), Carbon Calculator for Construction Activities (Jones, 2009) and ICE Database (Hammond & Jones, 2008a, 2008b).

In the past, government and industry have given greater attention to operational carbon management with less emphasis on embodied carbon assessment (BIS, 2010). However, as legislations intensify on reducing operational carbon the relative importance of embodied carbon and the carbon embodied in products is on the rise due to lack of attention (Sturgis & Roberts, 2010; RICS, 2012). Hence it is vital to further investigate some of the stated tools, currently and publicly available in the UK, for embodied carbon counting of construction, for comparison purposes (see Table 1).

Table 1: Comparison of UK open source construction carbon counting tools

Tool	Comment	System Boundary
Inventory of Carbon and Energy (ICE) Version 2.0 ICE was developed at the University of Bath	**Calculates:** embodied CO_2 and/ or CO_2e of approximately 200 different building materials. **Unit of measurement:** $kgCO_2/kg$ and/ or $kgCO_2e/kg$ OR $kgCO_2/m^2$ and/ or $kgCO_2e/m^2$. **Generic conversion factor:** CO_2e is 6% higher than the CO_2 value based on UK fuel mixes. **Note:** ICE used to be the only open source, freely available peer-reviewed tool available for its purpose until recently. CO_2e = carbon equivalent or greenhouse gases.	Cradle-to-gate
Construction Carbon Calculator Developed by the UK Environmental Agency (EA) and Jacobs Engineering	**Calculates:** CO_2e (in tonnes) of construction activities (i.e. CO_2e of construction materials and the CO_2e associated with their transportation, site energy use and waste). **Unit of measurement:** CO_2e per tonne. **Note:** developed using CO_2e values derived from ICE database. The tool (an Excel spreadsheet) allows inclusion of materials not covered if their CO_2e per tonnage is known.	cradle-to-end of construction
The Green Guide Developed by the Building Research Establishment (BRE)	**Calculates:** CO_2e of more than 1500 specifications of building materials and components in terms of various building element sections and subcategories across a range of 6 different generic building types. **Unit of measurement:** $kgCO_2e/m^2$ (on an elemental uniform basis). **Note:** the Green Guide Calculator is an online bespoke tool that generates CO_2e values not listed in the Green Guide (available in hardcopy print and also as an online tool).	Cradle-to-grave (over a 60 year building life)
CapIT/ Blackbook (Capital Cost and Embodied CO_2 Guide) Developed by Economic and Research Unit of Franklin & Andrews (part of the Mott MacDonald group)	**Calculates:** embodied CO_2 values of construction work activities including direct emissions from plants usage on site and tools. **Unit of measurement:** $kgCO_2$ per standard methods of measurement (SMM) work item unit **Note:** developed using ICE database and other reliable sources. Elements of waste have been included in the CapIT carbon figures. The database for the tool was developed in accordance with SMM with an embodied carbon value for each work item. The Blackbook is the hardcopy version of CapIT (which is regularly updated).	Cradle-to-gate (plus site and construction activities) OR Cradle-to-end of construction (minus transport)

Table 2 Cont'd: Comparison of UK open source construction carbon counting tools

Tool	Limitation	Reference
Inventory of Carbon and Energy (ICE) Version 2.0	**Lower level info:** embodied CO_2 values for primary materials like gravel, etc. and secondary materials like bricks, etc. Hence a tedious option to calculate embodied carbon for entire building. **Detailed information:** such as drawings, materials and project specification required for ease of use. **Unit of measurement:** not consistent for all the materials in the database.	(Hammond & Jones, 2008a, 2008b). University of Bath ICE Database. Initially, it was made freely available via an online website as an Excel spreadsheet. http://www.bath.ac.uk/research/features/embodiedenergy.html
Construction Carbon Calculator	**Lower level info:** CO_2e values for basic materials and composite items only. Hence a tedious option for embodied carbon calculation of buildings. **Detailed information:** required. **Coastal and fluvial projects**: tool only covers some materials mostly common to this kind of work. **Limited CO_2e data:** for building projects.	(Jones, 2009). EA Carbon Calculator. Freely available online as an Excel spreadsheet for public usage. http://www.environment-agency.gov.uk/business/sectors/37543.aspx
The Green Guide	**Carbon information source:** has been largely developed based on estimation. **Extent of information:** not all building elements and building element material specifications are covered. **System boundaries: a** single CO_2e value for cradle-to-grave does not allow embodied capital carbon analysis. **Service life:** of 60years assumed for the specifications and component though most buildings can last longer or less.	(Anderson *et al.*, 2009) BRE Green Guide to Specification. It is publicly and freely available online by registering on the BRE website and using the specified details to log in. http://www.bre.co.uk/login.jsp **General Note:** as 86% of the greenhouse gas emission is carbon related… (cont'd below)
CapIT/ Blackbook (Capital Cost and Embodied CO_2 Guide)	**Carbon information:** the tool appears to have embodied CO_2 values not CO_2e. **Extent of information:** the tool can be used to provide the embodied capital carbon analysis. The CO_2 values of construction work activities in CapIT however exclude plant and materials transport to site. **Info required:** need to identify all related construction work items (using bill of quantities) in order to estimate embodied CO_2 values.	(Franklin and Andrews, 2010) Mott MacDonald CapIT is available for public use on a paid subscription basis. http://www.capit-online.com/ **General Note Cont'd:** CO_2e has been consequently developed for the remaining 14% composed of CH_4, N_2O and refrigerant gases for uniformity of measurement (DECC *et al.*, 2008).

CONCLUSIONS

The introduction of stringent policies and government legislation to combat climate change is making carbon an increasingly important and major metric of building environmental performance. The total carbon emissions in a building can be divided into embodied and operational carbon. Embodied carbon from cradle-to-grave are emissions generated from the formation of a building, its refurbishment and subsequent maintenance and disposal whilst operational carbon are emissions arising from the use of the building over its entire life. To address growing environmental concerns whole-life carbon counting is inevitable. There are now standardised methods and several free online tools for operational carbon measurement due to its significant contribution to whole-life carbon, and perhaps the relative ease of calculation? Similarly, embodied carbon counting is becoming relatively significant with decrease in operational carbon. Yet, there is currently no formal assessment method for embodied carbon counting and relatively not many tools available in the public domain for this purpose.

The qualitative comparison of selected open source UK tools for embodied carbon counting revealed variances in the tools. Such include different boundary definitions, general assumptions, unit of measurements, level of information required and provided, and methodological differences in calculations. Indeed, these factors will affect the applicability of the tools and the credibility of the carbon data generated. Further research will explore these aspects and also test the tools using a particular building element to identify variances in results. RICS (2012) in their draft information paper argues that a common methodology is required to determine embodied carbon of a building through its life-cycle. This and the findings of the comparative analysis of carbon counting tools suggest the need for standardisation of embodied carbon measurement and tools to regulate whole-life carbon in buildings.

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DECISION-MAKING CRITERIA TO AID ENERGY-LED REFURBISHMENT OF EXISTING OFFICE BUILDINGS

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ABSTRACT

Pressure is growing upon large businesses to cut their energy consumption and carbon emission levels. Many operate globally within a large and varied property portfolio; often including hard to treat properties. Property portfolio managers (PPMs) within these organisations are faced with the challenge of making informed decisions regarding the optimum energy performance improvement measures (EPIMs) for their existing properties. This study will identify and evaluate the assessment criteria (AC) that should be used when deciding the suitability of EPIMs within the refurbishment of an existing office building that is classed as hard to treat. The AC will aid the PPMs to make decisions that are informed of the true impact an EPIM will have upon an existing building across the lifecycle of that EPIM. The final stages of data collection are in progress. Four rounds of online Delphi surveys with a select group of 'energy in buildings' experts has been used to establish a defined list of twenty-two AC. The AC range from short term impact (EPIM installation) to long term impact (EPIM operation and disposal) upon the property in question. The Delphi experts are currently in the process of weighting the AC in terms of their relative importance.

Keywords: decision-making, energy, refurbishment.

INTRODUCTION

Large businesses need to respond to high level, legislative drivers for change, in the way they view their energy consumption and wider sustainability issues. Some businesses already taking the initiative to invest in low carbon technologies will view new regulations as supportive and welcome their establishment (Okereke and Russel, 2010). However, studies have found that regulatory drivers are not the salient mechanism to impel businesses to reduce operational energy levels (British Standards Institution, 2009). A prominent driver has been the identification of climate change as a strategic issue in business management and its consequential impact upon a business' competitiveness (Okereke and Russel, 2010). It can therefore be suggested

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that many businesses do not view climate change and their resulting energy management approach as a process carried out to satisfy regulation but one that is inherent to their overall business strategy. It is in fact an economic opportunity, whether that be in the form of penalty avoidance or reduction in overhead costs. Studies have shown that the majority of professionals working within small, medium and large businesses believe that energy management strategy is very important to their business and will be increasingly so (British Standards Institution, 2009). A key element of energy management strategy is a company's property management team and how it is organised to achieve results. Many businesses now employ a dedicated energy manager who is set annual energy reduction targets, either as a contractual requirement or within a bonus incentive scheme. This pressure upon energy managers to meet targets combined with the overwhelming range of intervention options for existing buildings can make it difficult to make informed decisions when selecting the optimum energy performance improvement package. It is a complex decision making process, that can be classed as Multiple Attribute Decision Making (MADM). MADM can be characterised by alternatives, numerous attributes, attribute weights and incomparable units (Yoon and Hwang, 1995). In the context of this study, the alternatives are energy performance improvement measures (EPIM's). EPIM's have multiple attributes synonymous with assessment criteria; these are both qualitative and quantitative in nature therefore leading to incommensurable units of measurement. MADM involves evaluation of all available information and prioritisation of solutions. Prioritisation or ranking of the solutions requires some form of attribute weighting to allow scoring and comparison of alternatives. Decision-makers will have different views regarding the importance of a criterion, it is therefore necessary to use a recognised weighting methodology to determine the relative importance of each attribute/criterion. When a suitable expert participation group is applied to this methodology, a solid foundation is established to support a decision (Hamilton et al, 2007). The objective of this study is to define a set of assessment criteria against which to determine the suitability of an EPIM, and consequently aid decision making: these will subsequently be weighted. These criteria will specifically address existing office buildings, classed as hard to treat due to their traditional construction form. Traditionally constructed buildings, within the context of this study, are defined as:

1. Are likely to pre-date 1919

2. Are of mass masonry (stone or brick) wall construction

3. Originally have single glazed windows

4. Originally have no additional insulation materials built into the fabric

5. Are likely to have high air infiltration levels

Buildings of this construction type can often be found in the building portfolios of service sector and public sector organisations, providing them with a presence in many major city centres.

METHODOLOGY

A qualitative Delphi methodology was employed to achieve the objective in determining a comprehensive set of assessment criteria. Popularity of the Delphi technique dates back to the early 1960's, where it was primarily viewed as a mechanism for forecasting a future state (Gupta and Clarke, 1996). The technique has

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undergone many evolutions over time, to become a method that supports comprehensive decision making, planning and problem solving. It has been used in a wide range of sectors, examples include: construction (Hon, Chan and Chan, 2011; Manoliadis, Tsolas and Nakou, 2006), healthcare (Bond and Bond, 1982; Scheffner and Rubenfield, 2000) and information technology (Schmidt et al, 2001; Doke and Swanson, 2000). However, the core principle of the Delphi remains, the obtaining of a statistically significant consensus among a group of experts in a specific field, based upon their knowledge and experience, and is implemented through a series of iterative questionnaires, combined with controlled, anonymous feedback loops (Quade, 1970).

Participants

This study required an expert group that had an insight into energy performance improvements in existing buildings. A group of thirteen experts was recruited that included:

1. Built environment professionals; involved in energy use in existing buildings.
2. Property/facilities/energy managers working within both public and private sector organisations; responsible for building portfolio energy management.
3. Experts working within official advisory and regulatory bodies; involved in energy in buildings research and guidance.

The participants were categorised into five different groups. Some of the participants could be classed within multiple groups due to their professional activities. These groups were: industry professional, industry client, guidance, heritage and non-heritage.

The number of Delphi participants recommended in the existing literature varies from ten to fifty experts (Turoff, 1970). Nor does the existing literature reach consensus on the methodology by which to select an expert Delphi group. However, it is considered that an individual who is highly skilled, with specific, specialist expertise about a subject is an appropriate Delphi expert (Oh, 1974). In addition to this, the individual must have a reasonable approach, whereby they are open to revision of their views when presented with new information (Pill, 1971). Furthermore it is suggested that a heterogeneous group provides advantages in the capture of diversified, unbiased knowledge (Hon, Chan and Chan, 2011).

Procedure

In this work, the Delphi process was facilitated by the researcher remotely, meaning that the participants could range geographically, with the majority of communication carried out electronically, via email and online survey tools. A series of questionnaires were delivered to the participants in a total of three rounds. A series of three survey rounds is recommended as a guide (Custer, Scarcella and Stewart, 1999). Time was required between each survey round to allow the facilitator to analyse and construct feedback of the experts' anonymous views. Furthermore, sufficient time was permitted to allow each participant to consider the content of each questionnaire as well as the feedback of others' views before responding. This time allowance is recognised as one of the main challenges associated with the Delphi technique (Hsu and Sandford, 2007).

The overarching question posed to the experts was, 'What criteria should built environment professionals use to assess the suitability of an energy performance improvement measure for an existing building?' This was supported by a detailed

explanation of the purpose and objective of the study, as well as contextual information relating to the specific traditional building type. The initial questionnaire was presented to the participants with a preliminary set of assessment criteria; this was derived from the researcher's fundamental knowledge and experience of the subject area. They were then provided with seven questions that allowed them to amend the preliminary criteria to align with their expertise. This was repeated twice, until the majority of participants had arrived at a consensus.

RESULTS

The preliminary set of fifteen assessment criteria was adapted and developed through the Delphi process into a set of twenty-two assessment criteria, to which all thirteen participants individually contributed. Table 1 shows the finalised set of both qualitative and quantitative criteria, presented in a format that illustrates the lifecycle of the EPIM. Concise definitions were created for each criterion, see Table 2.

DISCUSSION

Making Informed Decisions

Some Delphi participants felt it was necessary to categorise the assessment criteria to represent the lifecycle of an EPIM. This format aids the decision maker to make an informed decision, as it provides a structured, methodical approach to intervention selection (and once weighted) prioritisation. It is an approach that takes into consideration both the short and long term impacts of the intervention, upon the building in question. It encourages the decision maker to assess not only financial, but also technical, practical and social acceptability factors within the selection process. The spread of the criteria across the EPIM lifecycle is interesting in that it shows that the majority of criteria to be considered are within the operational phase of the EPIM. This may be unexpected as emphasis is often placed upon the short term impacts of an intervention. However, the subsequent weighting of these criteria will truly determine which lifecycle phase is considered to be the most important within the decision making process.

Building Occupants

The consideration of building occupants when undertaking works to a property is twofold: firstly, their comfort within the building and secondly, their understanding of how the building environment is controlled to maintain accepted comfort standards whilst simultaneously sustaining operational efficiency. The results show two criteria addressing occupancy comfort; consequently, the decision maker will consider these during the selection process. This will aid the decision maker to communicate the benefits of the works to the users. An understanding of these benefits would support and encourage participation in training of new systems post refurbishment; the third occupancy related criteria in the results.

Hard to Treat

Experts with a professional background in heritage of the built environment identified the fact that it is not only about intervention in a building's appearance, but also the building fabric. The 'loss of building fabric' was identified as a criterion in round one of the Delphi survey and then adapted to 'loss of significant, building fabric' in round two. This criterion combined with 'impact on building's appearance', and 'impact on building's internal layout/space' will aid the decision maker to realise the full impact

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upon the building in question. This encourages the decision maker to consider similar criteria to those governing bodies who grant consent for intervention in properties of historical importance, therefore adding a practical element to the EPIM AC.

How the Criteria will be used

Strachan and Banfill (2012) have created an optimum approach to the energy-led refurbishment of existing, non-domestic buildings; a Decision Support Tool (DST). This DST will use the assessment criteria from this study to aid prioritisation and selection of EPIM's. The output for each EPIM will be a score. This score will allow direct comparison of each EPIM with one another. It will be an indication of how well the attributes of the EPIM meet the assessment criteria; the product of an attribute scoring matrix and assessment criteria weighting calculation. The higher the overall score, the higher the likelihood that that EPIM will be suitable for the building under consideration.

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Table 1 – Finalised List of Assessment Criteria

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Energy Performance Improvement Measure (EPIM) Assessment Criteria (AC)		
EPIM AC		**EPIM AC Definition**
1	Capital cost	Initial cost incurred to purchase the EPIM, including all associated transport, labour and materials.
2	Availability of grants, tax allowances and other financial incentives	The availability of financial incentives for the implementation of particular EPIM's.
3	Ease of installation of EPIM	Also known as 'buildability'. The level of difficulty associated with the installation of an EPIM, including ease of transport to and movement on site.
4	Loss of significant original building fabric	Some EPIM's installation will have a low visual impact but may result in loss of significant, original building fabric.
5	Requirement of planning and/or building control approvals	The likelihood of requiring some form of formal approval for the installation of an EPIM, including Listed Building Consent where applicable.
6	Level of disruption to building occupants during works	The level of disruption caused by the installation of an EPIM on the building occupants' working environment, and consequently their productivity.
7	Impact on building's appearance	The impact the installation of an EPIM will have upon a building's appearance, both externally and internally.
8	Impact on building's internal space/layout	The installation of some EPIM's could impact upon the gross internal floor area or the internal layout of the building.
9	Potential energy/carbon savings	A quantitative measure of the energy savings and associated carbon emission savings of installing an EPIM.
10	Financial payback	A measure of the time required to recover the initial cost invested.
11	Change to maintenance costs	A potential increase or decrease in the building user's maintenance budget due to the installation of an EPIM.
12	Ease of maintenance of EPIM	The level of difficulty associated with the maintenance of an EPIM and any associated equipment or materials. Including the availability of spare parts over the lifetime of the EPIM.
13	Reliability of EPIM's performance	The reliability of an EPIM's performance. Risk of failure in meeting predicted energy savings, as well as any other performance criteria.
14	Degradation of EPIM's performance	The potential year on year reduction in the EPIM's ability to deliver energy savings.
15	Training building occupants in the use of new system(s) post refurbishment	The level of training and regular re-training required of building occupants to ensure the EPIM is operated at its maximum efficiency.
16	Level of improvement in building occupants' comfort	The level of improvement in indoor environmental quality due to EPIM installation, consequently improving the building occupants' comfort levels and potentially, worker productivity.
17	Impact on existing building services	The impact the EPIM's installation will have upon the existing building services (BS), including building fabric improvements, as these will change the internal environment and how it interacts with the BS. Some BS-related EPIM's can have a negative impact on the existing plant and its maintenance, this must be considered.
18	Impact on building's internal air movement/ventilation	The impact of the EPIM's installation on how the existing building deals with air movement. A negative impact could lead to serious air quality and condensation issues. Also, whether changes to the building's ventilation strategy need to be considered as a result of this EPIM.
19	Impact on building's vapour permeability/'breathability	A qualitative measure of the impact an EPIM's installation has on the building fabric and how it interacts with moisture. Whether or not that EPIM is compatible with the existing construction form.
20	Disposal cost of EPIM at end of useful life	The financial cost of removing and disposing of the EPIM and any associated parts at the end of their useful life.
21	Embodied energy/carbon of EPIM	The total energy/carbon inputs required to manufacture an EPIM and its associated materials, from extraction of raw materials to reuse/recycle/disposal. This also covers the issue of EPIM availability, in terms of the energy/carbon cost of sourcing and transport.
22	Environmental impact of EPIM	The level of pollutants/environmental cost accumulated in the manufacture of an EPIM and its associated materials, from extraction of raw materials to reuse/recycle/disposal.

Table 2 – EPIM AC Definitions

DISCUSSION (Cont'd)

Weighting of Criteria

To capture the expert group's views on the relative importance of the finalised assessment criteria, they must be weighted. This is currently being undertaken by the expert group and will be reported later. Collecting expert views regarding the weighting of multiple criteria has been viewed as a preferred method over purely analytical methods (Eckenrode, 1965). However, determination of criteria weights is a complex process due to the often conflicting nature of the criteria, and an appropriate method for elicitation of the expert weightings must be carefully selected. There are many techniques available, and their attributes have been analysed and compared within existing literature (Bartlett, Heermann and Rettig, 1960; Eckenrode, 1965; Hobbs, 1980; Hajkowicz, McDonald and Smith, 2000). The paired comparison method is relatively well known within weighting methodologies and will be adopted in this next study. This is a process by which each criterion is compared with every other criterion within individual pairs, allowing the expert to indicate their rating of importance using a nine point scale. This methodology is time consuming for the experts but previous participants have concluded that it supports better understanding of the problem presented to them (Hajkowicz, McDonald and Smith, 2000). Once the expert group are satisfied with the assessment criteria and their weightings, they will then be applied to a real refurbishment project, in a follow up case study.

CONCLUSION

A set of assessment criteria, by which to determine the suitability of an EPIM for an existing, hard to treat, office building, has been defined in this study. The criteria and their presentation provide an element of standardisation to the complex multiple attribute decision making process of energy performance improvement. They consider all stages of an EPIM's lifecycle to aid an informed decision. The assessment criteria are currently being weighted in terms of their relative importance, through a pairwise comparison.

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ENVIRONMENTAL AMENITY COMPARISONS IN RESIDENTIAL REAL ESTATE VALUATION

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ABSTRACT

Environmental valuation techniques have been used in quantifying the pecuniary influences of exogenous features of buildings. This study adopts such methods in pricing environmental amenities within the context of a housing market. The effects of both man-made and natural neighbourhood features on property prices are analyzed as derived from the status, inclinations, and implicit values of these attributes. Though the theme of this study has attracted pedagogical attention in literature, the comparison between man-made and natural environmental amenities being articulated in housing values is a nouvelle approach in identifying and explaining demand systems in relation to externalities. Using a vibrant residential property market within Lagos, Nigeria, primary data on these neighbourhood features were subjected to a regression analysis and descriptive statistics. Data used were collected with the aid of questionnaires which were administered on a systematically selected sample. Results reveal the inherent variations in the significance of physical infrastructure and natural amenities as capitalized in housing values through market process. Implications of this study identify areas of investment concentration in the face of budgetary constraints. This is expected to provide necessary guide for development sustainability in designing housing and urban settlement schemes.

Keywords: Environmental valuation, Housing market, Natural amenities, Physical infrastructure, Property value.

INTRODUCTION

Environmental amenities as a generic term refer to outdoor public goods and services that are in place to give invaluable support to man's existence and activities, whilst also providing recreational, health, psychological, and operational opportunities within it coverage area. Environmental amenities, contextually, are sub divided into man-made (physical infrastructure) amenities and natural amenities. Physical infrastructure according to Famuyiwa and Otegbulu (2012) are man-made municipal services or facilities that are designed to aid the proper functioning of productive activities in a region. These services can be provided through private or public means, and include highways, streets, roads, and bridges; water supply; waste water treatment; water

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resources; solid waste; and hazardous waste services, airports and airways; public transit; intermodal transportation as key examples More recently, the term has gone to include information technology systems such as internet services, geographic information systems, etc. On the other hand, natural (environmental) amenities are all those natural assets including green spaces that are aesthetic, ecological, and economic in nature, as well as those that have a physical or psychological effect on human health such as the provision of recreational opportunities (Gupta, Mythili and Hedge, Undated). Key examples are the presence of trees, lakes, rivers, flowers, open fields etc, within a neighbourhood.

Environmental amenities confer significant influences on the market value of properties as the components of housing go beyond just the physical structure. These goods (or services) perform important functions in aiding the activities, and health of building dwellers. For example, physical infrastructure such as pipe-borne water eases household chores. Also, the presence of natural environmental amenities (e.g. the view of a lake) within a neighbourhood impacts positively on the health and well being of inhabitants in the area. Beauchamp and Abramwoski (2012) observe that natural environmental amenities may increase the market value of a house by 5 to 25%. In the same regard, physical infrastructure also influences the market values of properties positively (See Odudu, 2003; Adebayo, 2006).

Value essentially emanates from demand, and demand arises from factors such as desirability, utility, and most especially, the ability to satisfy a need. Market Value of properties extend to encompass the components of the immediate environment, while constituting an amalgamation of structural, location, and neighbourhood attributes (Rosen, 1974). The International Valuation Standards Committee - IVSC (2012) describes market value as 'the estimated amount for which an asset should exchange on the date of appraisal between a willing buyer and a willing seller in an arm's length transaction after proper marketing wherein the parties had each acted knowledgeably, prudently and without compulsion'.

Recently, environmental issues have attracted attention in economic and real estate literature, particularly with respect to their impact on property prices. (Des Rosiers, Bolduc and Theriault, 1999). Ge and Du (2007) also observe that market value of properties is an essential aspect of property markets worldwide, and determining their value inducing factors is a significant part of the valuation process. In this process, environmental goods and services require sophisticated and 'un-traditional' techniques in arriving at their implicit values. Mishra (1998) in Holvad (2000) in Otegbulu (2010) explain that not many environmental and public goods and services have markets and therefore, prices of only a few of them could be available as comparable data. Their prices too, are only the indicators of the minimal payments at which the consumers and the producers have agreed to enter into transactions. At these prices, there may be substantial consumers/producer surpluses that go unaccounted for. The worth of environmental goods and services include these unaccounted surpluses, but their prices are not generally reflected in their worth. Hence the need to resort to Environmental Valuation Techniques such as the Hedonic Pricing Model (HPM). The HPM was birthed by Rosen (1974) and remains the most reliable tool for such purposes (Famuyiwa and Otegbulu, 2012). The model explains property values as an amalgamation of various

building characteristics viz, physical, structural and neighbourhood-related, and has remained extensively used in empirically evaluating housing characteristics. It is similarly adopted in this study to value the effects of both man-made (physical infrastructure) environmental amenities, and natural environmental amenities.

The growing awareness of the importance of nature and biodiversity especially where there is human habitation and the glaring evidence of the need for adequate and efficient physical infrastructure, for social and economic development, public health, enhanced productivity, time savings, amongst others are major considerations igniting this study. Consequently, environmental features should therefore be given adequate consideration in overall planning of the built environment. Otegbulu (2011) notes, for example, that in spite of the huge environmental and energy problem in Nigeria, designers have not seen the need for a shift from their traditional methods of designing buildings, and buildings with holistic approaches are yet to be seen.

Though previous studies have given attention to the central theme of this research, the comparative analysis of man-made and natural exogenous features of buildings has not been given adequate consideration especially in Nigeria. Consequently, this study attempts to draw a broad and concise analysis of the influences of environmental attributes (both man-made and natural) on property values. The aim is to examine value demand systems under consideration as reflected in housing prices within the study area. This is with a view for possible guidance in land use planning and smart growth development.

This paper is structured into five sections. This part has introduced the subject matter of the paper. The second section discusses key variables of this study under an apt literature. In the third part, the methods adopted in fulfilling the objectives of the study are presented. The findings and results of the research are discussed in the fourth section, followed by concluding comments and remarks in the last part of the paper.

ENVIRONMENTAL VALUATION IN REAL ESTATE – PREVIOUS STUDIES

In determining the implicit prices of value inducing variables in the housing market, several methods have been employed in previous empirical studies, with each yielding meaningful insight. Various environmental attributes (man-made and natural) have also constituted key variables in these studies. Romkaew (undated) explains that many researchers suggest that the characteristics of the local neighborhood, and environment quality are of great importance in the determination of residential property prices, but Wise et al (2010) in Beauchamp and Abramwoski (2012), remark that the difficulty lies in integrating the evaluation of multiple benefits, quantifying benefits that may not be easily monetized and bringing recognition of these values into infrastructure investment decisions by developers, communities, and agencies.

Gupta, Mythili and Hegde (undated), attempted to capture the impact of environmental, structural and location variables on housing prices prevailing in Mumbai, India. The revealed preference approach specifically concentrating on the hedonic pricing model was used to weigh the significance of key variables used in the survey with primary data using 578 households. It was found that ‘proximity to water body’ and 'garden proximity'

were the two most significant variables. Though the study highlighted the proximity to railway station as a variable in the hedonic price function, this amenity was classified as a location attribute. Moreover, there was no weighting of any other public physical infrastructure. As Kyrvobokov (2007) suggests, the comparative influence of the attributes is important and not how one or another attribute influences the value.

Jim and Chen (2007) aimed to investigate home buyers' preferences in relation to outdoor environmental attributes and also to assess actual monetary values attributed to environmental externalities using a hedonic pricing analysis. Study areas included three housing sub markets in Guanzhou, China. The variable 'green view' had the most significant positive regression (of all environmental amenities) on price in the study area. 'Buildings view' had a negative impact on housing prices in all three housing submarkets. The results of such studies in Asia may however not be extendable to a city like Lagos.

Kenyon-Henderson and Song (2008) assessed the marginal value of several types of open space in a single family residential market. In adopting appropriate research methods, the hedonic modelling was used. Variables included the property's access to different types of open spaces, propertys' structural features, public services, disamenity features, neighbourhood socio-economic characteristics, and accessibility measures. The findings were that housing prices increase with proximity to certain types of open land uses, and that the size of those nearby open spaces also impacts on home prices. More notably, the value of being adjacent to public open spaces, having more public open spaces within walking distance of the property, and being closer to the nearest open space was found greater for properties with smaller private yards.

More locally, Babawale and Johnson (2012) explored the effects of housing attributes on the price structure of duplexes in Lekki Peninsular, Lagos, Nigeria. The results suggest that the availability of 'boys quarters' and 'structural quality of property' are the highest principal determinants of prices for duplexes in the area, while the 'view of ocean/ lagoon' constituted approximately 6% of the market value of property.

In as much as it was endeavoured in this paper to concentrate the literature review on study areas with similar socio-economic characteristics, a few studies in Europe and America have proven very pivotal and indispensible in this study. Also, is the dearth of literature from local studies.

STUDY AREA AND RESEARCH METHODS

The main objective of this paper is to specify environmental attributes (physical infrastructure and natural amenities) that significantly influence the prices of houses/ residential buildings in Yaba local government area of Lagos State. Yaba Local area was carved out of the old Lagos Mainland local government which was created in 1977 as a separate Local government following the national reform of Local governments in September 1976. The area is bounded on the north by Shiro Street down to the other side of Morocco road at the roundabout to include Abule- Ijesha. It is bounded on the south by Murtala Muhammed way stretching from Jibowu to Wright street junction. On its East, it is bounded by the Lagos lagoon behind Onike, Onitiri, Makoko, Iwaya, University of Lagos communities to the lagoon, and on the west, by the descent of 3rd Mainland

Bridge to Wright Street to Murtala Muhammed way to include the Total services station at that junction. The area covers geographical coordinates 6° 29' 23" North, 3° 23' 1" East and is still one of the few existing regions in Lagos state which still draws from its colonial heritage. The area has a mix of all socio-economic classes of inhabitants, and also of mixed land uses. Yaba Local Council area wears an urban setting; some parts however mirrored rural features and these areas are simply referred to as blighted areas like Makoko and Iwaya. Nonetheless, Yaba Local Council Development area is a commercial nerve centre regardless of its political and cultural affiliations.(Wikipedia). This study however did not cover Makoko and Iwaya mentioned above, due to their slum characteristics. The decision to exclude such locations from the study area arose in order to avoid bias in the aggregate results. Characteristically, these blighted areas practically have little or no amenities; hence majority of variables employed would have no relevance if they were factored into the overall model.

Due to the apparent lack of reliable secondary data in the study area, the main research instrument used was the structured questionnaires. In selecting the sample of this study, a multi-stage approach was adopted. The first stage involved ascertaining the number of streets within the Local Government Area. The second stage involved randomly selecting four houses from each street. A total number of 45 streets were identified; consequently, 180 questionnaires were administered. 148 were retrieved, but only 106 were found useable for analysis. The homogenous tendency of houses on the same street in the study area informed the choice of this sampling approach.

The data gathered were analyzed with simple descriptive and inferential statistics. The Hedonic Pricing Model was used to bring out value inferences of various environmental characteristics used in the study. The variables were drawn from similar studies and then modified to suit the specific circumstances of the study area. As a general rule, it is better to over-specify the model (include too many variables), than to under-specify it (omit important variables) (Johnson-Gardner, 2007). Omitted Variable Bias, is introduced when key variables that should be included are not. This leads to results that over-express the importance of an included independent variable's explanatory power when regressed on the dependent variable.

A pilot study identified variables above relatively significant to property values within the study area. Further, of particular relevance is the hedonic pricing method instituted by Rosen (1974), which uses differences in property market values to identify the demand schedule for local environmental amenities, and was adopted in this study. Table 1 provides the description of the variables used for the hedonic pricing model. The table also provides the measurement of the variables used in the study.

Table 1: Definition of Regression Variables

Variables Definition	Acronym	Measurement
Net Rental Value	RTVL	Measurement in Nigerian Naira (N)
Structural Quality Of Property	STRQUAL	Good =1; Bad = 0
State Of Repair Of Property	STREPAIR	Good =1; Bad = 0
Building Age	BLDAGE	Number of years
Natural Lighting	NTLIGHT	Good =1; Poor = 0
Distance To Closest Central Business District	DISCBD	"1" if within 15 minutes driving distance, "0" if otherwise

Distance To Recreation Centres	DISRECR	"1" if within 15 minutes driving distance, "0" if otherwise
Neighbourhood Security	NEIGSEC	Good =1; Poor = 0
Neighbourhood Serenity	NEIGSER	Good =1; Poor = 0
Neighbourhood Prestige	NEIGPRE	Yes =1; No = 0
Nature Of Road Surface	NTROAD	Good = 1; Bad = 0
Government Water Supply	GWATER	Good = 1; Poor = 0
Government Waste Disposal Services	GWASTE	Available = 1; Not available = 0
Street Lightings	SRTLIGHT	Available = 1; Not available = 0
Drainage	DRAIN	Good = 1; Bad = 0
Green Environment in Neighbourhood (e.g. trees, flowers)	GRNENVR	Available = 1; Not available = 0
Private Garden Space	PGARDEN	Available = 1; Not available = 0
Wind Quality in Building (Ventilation)	WINDQUA	Good = 1; Poor= 0
Landscape Of Neighbourhood	LDSPNEIG	Good =1; Poor = 0
Navigable water Body in close proximity	NVWATER	Available = 1, Not Available = 0
View of Navigable water body	VIEWWAT	Available= 1; Not Available = 0

FINDINGS AND DISCUSSION

This section of the paper discusses the results of the research and data analysis employed for the study.

Table 2: Descriptive Statistics of Regression Variables

	MINIMUM	MAXIMUM	STD	MEAN
RTVL	60000	3600000	961095	1426100
STRQUAL	.00	1.00	.2937	.9057
STREPAIR	.00	1.00	.3773	.8302
BLDAGE	1.00	50.00	12.4963	18.1304
NTLIGHT	.00	1.00	.47136	.6731
DISCBD	.00	1.00	.49508	.5849
DISRECR	.00	1.00	.49144	.3962
NEIGSEC	.00	1.00	.47583	.6604
NEIGSER	.00	1.00	.50157	.5283
NEIGPRE	.00	1.00	.47583	.6604
NTROAD	.00	1.00	.44297	.7358
GWATER	.00	1.00	.43230	.2453
GWASTE	.00	1.00	.46126	.6981
SRTLIGHT	.00	1.00	.45261	.2830
DRAIN	.00	1.00	.48184	.6415
GRNENVR	.00	1.00	.45790	.2941
PGARDEN	.00	1.00	.34582	.1373
WINDQUA	.00	1.00	.49064	.6078
LDSPNEIG	.00	1.00	.49868	.5625
NVWATER	.00	1.00	.39602	.1923
VIEWWAT	.00	1.00	.23429	.0577

In Table 2, the descriptive statistics of residential properties in the study area are presented. All variables asides 'Building Age' and 'Rental value' (net) were estimated using dummy measurements in coding. The upper and lower limits of the coded dummy variables were represented by "1" and "0" respectively. The average net rental value (being the independent variable) in the location is estimated at N1,426,100, with maximum value and minimum values of N3,600,000 and N60,000 respectively. The

average age of properties is estimated at 18.13 years. These two attributes were estimated with continuous variables, as mentioned above.

Table 3: Regression Results

	Unstdz. Beta	Std. Error	Stdz. Beta	T	Sig.	Part Correlation	Tolerance	VIF
Constant	668029.960	197397.765		3.384	.001			
STRQUAL	1941310.495	374889.779	.593	5.178	.000	.244	.169	5.909
STREPAIR	-1387684.317	307234.164	-.545	-4.517	.000	-.213	.153	6.549
BLDAGE	-54014.838	5314.797	-.702	-10.163	.000	-.479	.465	2.150
NTLIGHT	1194772.329	219700.694	.586	5.438	.000	.256	.191	5.228
DISCBD	772926.624	138801.998	.398	5.569	.000	.262	.434	2.302
DISRECR	527538.836	128557.737	.270	4.104	.000	.193	.514	1.946
NEIGSEC	486372.877	168005.933	.241	2.895	.005	.136	.321	3.115
NEIGSER	-808709.577	184791.841	-.422	-4.376	.000	-.206	.239	4.188
NEIGPRE	298042.077	164673.062	.148	1.810	.075	.085	.334	2.993
NTROAD	-843059.140	239362.945	-.389	-3.522	.001	-.166	.182	5.481
GWATER	-447453.122	208627.077	-.201	-2.145	.036	-.101	.252	3.965
GWASTE	731921.491	175377.079	.351	4.173	.000	.197	.313	3.190
SRTLIGHT	-1345581.905	186913.796	-.634	-7.199	.000	-.339	.287	3.489
DRAIN	476864.466	139212.564	.239	3.425	.001	.161	.456	2.193
GRNENVR	997125.677	171855.987	.475	5.802	.000	.273	.331	3.019
PGARDEN	-571724.735	168378.276	-.206	-3.395	.001	-.160	.605	1.653
WINDQUA	-1503361.605	256217.425	-.642	-5.868	.000	-.277	.186	5.389
LDSPNEIG	1475420.313	160156.405	.766	9.212	.000	.434	.322	3.110
NVWATER	366978.433	162335.908	.151	2.261	.027	.107	.496	2.015
VIEWWAT	-1051607.054	311397.873	-.256	-3.377	.001	-.159	.385	2.595
R	0.930							
R^2	0.865							
Adj. R2	0.820							
Durbin-Watson	1.718							
F-statistic	19.465***							

*** significant at 1%

According to Selim (2008) in Babawale and Johnson (2012), there is little guidance from economic theory about the proper functional relationship between house price and its attributes. The estimation and selection of hedonic pricing equations has therefore been a major concern because there is not enough guidance from theory about the proper relationship between housing prices and their preferred attributes, and differences between equations and related econometric issues have been widely explored (Jim and Chen,2007; Habb and McConnell,2002). Widely used functional forms include the linear form, semi-logarithmic form, Box-Cox transformation, and reciprocal form.

The hedonic pricing regression estimates for this study are presented in Table 3. A linear model was adopted based on the preponderance of this method in similar studies.

The analysis above depicts the R and Adjusted R- square values of 0.930 and 0.865, respectively, which implies that structural, location, neighbourhood and natural environment attributes included in this model are jointly, strongly correlated with net

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rental value in the location of the study. The influences represent approximately 86.5% of rental value. An R^2 value of 0.865 suggests that both the explanatory and predictive performance of the model is reasonably good. The individual relationship of each of the attributes to value is shown in the first column. Figures with negative signs imply a negative relationship with rental values in the study area. While figures with positive sign implies positive influence in rental values in the study area. From table 3, it can be seen that 'Structural quality of property' has very high and positive correlation with rental values in the study area. As expected, older buildings attract low values compared to new ones, confirming the theory that building age, and property values are negatively correlated. The study shows that every periodic increase in the age of a building will likely result in a corresponding decrease in rental values by N54,014.84. Neighbourhood attributes such as security, prestige, government waste disposal services and drainage significantly contribute to rental values in the location. Availability of good security constitutes N486,372.88 of value while 'neighbourhood prestige' constitutes up to N298,042.08 of rental value. With government providing waste disposal services, the rental value of the property rises by N731,921.49 while good drainage systems in the neighbourhood attracts high rental value to the tune of N476,864.47. Far from a-priori expectations,' nature of road surface' as an independent variable, does not constitute a positive component of rental value in the study area as can be seen in the table above.

There are six natural environment attributes that are statistically significant on rental value in the location of the study. However, only three of the attributes have positive effects. These are 'green environment in neighbourhood', neighbourhood landscape and navigable water body. Of these three, 'neighbourhood landscape' was highest with 1,475,420.31. The other two viz 'green environment' and 'navigable water body' respectively constituted N997,125.68 and N366,978.43. Environmental attributes with negative effects are 'private garden space', 'wind quality within premise's and 'view of navigable water body'. These attributes might not be expected to negatively correlate with value as recorded in this study but the incongruence might have emerged from data collection process. Same also applied to a few 'location attributes' and some' structural' and 'neighbourhood attributes'.

Although absence of serial autocorrelation among the regression attributes cannot be ruled out, the significance of F-statistic, 19.465; $p < 0.001$ implied the accuracy of the regression model in predicting rental value.
Hence, the hedonic pricing model developed from this study is stated as:

$$\begin{aligned} RTVL = {} & 668029.96 + 1941310.50STRQUAL - 1387684.32STREPAIR - 54014.84BLDAGE \\ & + 1194772.33NTLIGHT + 772926.62DISCBD + 527538.84DISRECR + 486372.88NEIGSEC - \\ & 808709.58NEIGSER + 298042.08NEIGPRE - 843059.14NTROAD - 447453.12GWATER + \\ & 731921.49GWASTE - 1345581.91SRTLIGHT + 476864.47DRAIN + 997125.68GRNENVR - \\ & 571724.74PGARDEN - 1503361.61WINDQUA + 1475420.31LDSPNEIGH + \\ & 366978.43NVWATER - 1051607.05VIEWWAT + \epsilon \end{aligned}$$

CONCLUDING REMARKS

Environmental amenity implicit costs in rental values within the context of physical infrastructure and naturals amenities for residential buildings within Yaba Local Government area in Lagos State, Nigeria were evaluated using primarily, the hedonic

regression model. Using the hedonic model, with current data, the aggregated influence of environmental attributes studied, was up to 85% of rental values. This study does not address the environmental costs and benefits of a proposed project, nor the willingness to pay for environmental amenities within the study area. The evaluation of green infrastructure vis a vis physical urban infrastructure should be a major consideration in neighbourhood and town planning schemes. According to Jim and Chen (2007), a good environment plays important roles in relieving congestion and the monotony of a built up setting and their aggregate effects contribute significantly to improving the quality of urban life, and sustainability of urban eco systems. In Lagos today, there is this continuing struggle in to adequately accommodate the influx of people from rural areas. This is mainly due to the lack of a proportionate 'rise' in land, and physical (public) infrastructure development. In settlements like this , the rapid pace of 'creating land' for new building developments has left most parts without green spaces, or natural amenities (such as trees, open fields, public gardens, etc) and the colonial fabric of the region - characterized by a well planned design, green areas, open spaces, green fields, trees, and other natural features is fast disintegrating. The evaluation of both man-made and natural environmental amenities in property prices should be given increased attention in empirical discourse. Areas of further study can be extended to consumer preference of environmental amenities as well as the willingness to pay for these amenities.

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INVESTMENTS IN BUILDING SOLAR ENERGY SYSTEMS: FINDING PROPER INTERVENTION TIME

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ABSTRACT

Transformative technologies such as Photovoltaic (PV) systems can substantially reduce carbon emissions of the building sector. Nevertheless, implementing PV systems requires considerable initial investments that should be recovered through uncertain savings in electricity bills. An appropriate investment valuation method is needed to conduct tradeoff analysis between uncertain electricity saving benefits and implementation costs and find the value of investment in PV systems. Currently, investments in PV systems are valued based on conventional methods, such as payback period and net present value. Nevertheless, existing methods do not address two major issues that impact the value of investments in PV systems: uncertainty and timing. In this paper, a Real Options model for the valuation of investments in PV systems for buildings is presented. It accounts for the uncertainty about respective energy saving benefits from implementation of PV systems and conducts tradeoff analysis between their energy saving benefits and implementation costs. Based on this tradeoff analysis, the proposed model identifies the optimal time to implement PV systems in buildings. This model helps commercial and residential real estate owners and investors, designers and builders, and policy makers make better decisions about the adoption of PV systems in buildings.

Keywords: building energy improvement, photovoltaic systems, proper timing, real options model.

INTRODUCTION

Buildings have a significant impact on the nation's energy use. Commercial and residential buildings use almost 40% of the primary energy (almost 40 quadrillion Btu (quads) per year) and approximately 70% of the electricity in the U.S. (DOE 2009). Transformative technologies, such as Photovoltaic (PV) systems that provide nonpolluting renewable energy are critical to meet these ambitious energy reduction

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goals. One of the most formidable barriers to implement PV systems in buildings is their high implementation costs. PV system implementation projects require substantial implementation costs followed by a long period of recovering the invested capital through savings in electricity bills (Supple 2010). Energy saving benefits following the implementation of PV systems should be compared against respective implementation costs, in order to determine investment values. Currently, the valuation of the investments in PV systems are made based on the conventional methods, such as payback period, return on investment (ROI) and net present value (NPV) (Muldavin 2010; Prindle and de Fontaine 2009). Existing methods do not address two major issues that impact the value of investment in renewable energy systems: uncertainty and timing.

The amount of energy saving benefits realized over time following the implementation of PV systems is subject to significant uncertainty. Existing valuation methods do not explicitly account for uncertainty about future retail prices of electricity in the characterization of energy saving benefits following the implementation of PV systems. Additionally, current valuation models are not able to determine the most appropriate time to implement of a PV system. This paper takes a different approach towards the valuation of investments in PV systems for buildings. The Real Options Theory from finance/decision science is utilized in order to overcome the above limitations of existing investment valuation methods for PV systems. The objective of this research is to create a novel investment valuation model that accounts for changes in the implementation costs of PV systems as well as the uncertainty about their respective energy saving benefits. This investment valuation model can be used to find the best time for implementing PV systems in buildings, as well as financial values of properly-timed investments in PV systems.

LITERATURE REVIEW

NPV is the standard method of current literature in the valuation of sustainable buildings (ASTM E917–05 2010; Kibert 2008; Vanek and Albright 2008). Nevertheless, despite its popularity, the NPV method has serious limitations when it comes to the financial valuation of the investments in PV systems. First, the NPV method does not explicitly account for the uncertainty about future energy saving benefits resulted from the implementation of PV systems. Second, the NPV method is inherently unable to address the investment timing (Trigeorgis 1996; Leslie and Michaels 1997). Without an appropriate investment valuation method – that addresses the uncertainty about energy saving benefits as well as the investment timing – the risk that the scarce financial resources are misappropriated is imminent. The Real Options Theory offers an alternative method for investment valuation that can overcome the limitations of the NPV analysis approach (Copeland and Antikarov 2003; Copeland and Antikarov 2003).

The term “Real Options” refers to the application of financial option pricing techniques to the assessment of non-financial or “Real” investments that are subject to considerable uncertainties and have strategic management flexibility features, such as the ability to choose investment timing. This field has gone through a significant transition from a topic of modest academic interest in 1990s to considerable, active academic and industry attention (Borison 2005). Previous research efforts have been focused on the application of real options analysis in real estate and property valuation (Ashuri 2010; Guma et al. 2009; Hutchison and Schulz 2007; de Neufville et al. 2006) and building systems design and engineering (Greden et al. 2006).

Nevertheless, the literature review indicates that real options analysis has not been applied to evaluate investments in PV systems in buildings.

INVESTMENT VALUATION MODEL FOR RENEWABLE ENERGY SYSTEMS IN BUILDINGS

The proposed investment valuation model takes into account the changes in implementation costs of PV systems, as well as the uncertainty about future energy saving benefits. It identifies the best time for implementing renewable energy systems, and establishes the financial values of properly-timed investments in PV systems. The modeling steps are:

1) The characterization of the uncertainty about energy saving benefits following the implementation of PV systems;
2) The characterization of changes in the implementation cost of PV systems over time;
3) The identification of the best time for the implementation of PV systems in buildings; and
4) The characterization of the financial risk profile of properly-timed investments in PV systems.

Characterize the Uncertainty about Energy Saving Benefits Following the Implementation of PV Systems in Buildings

Energy saving benefits are the electricity consumption costs that are avoided as a result of implementing PV systems in buildings. At any time the energy saving benefit is the product of "the amount of electricity generated by PV systems" and "the retail price of electricity." The amount of electricity generated by PV systems is specified by the system manufacturers. The retail price of electricity is multiplied by the amount of electricity generated by PV systems to determine the energy saving benefit of PV systems. Historical data show that, while retail prices of electricity rise on average over time, they are subject to short-term variations (EIA 2010). Therefore, the volatility of electricity prices makes energy saving benefits time-variant and subject to uncertainty.

A binomial lattice model for the long-term retail price of electricity

Binomial lattice models are discrete random walk models that are commonly used in economics and finance for capturing the uncertainty about a parameter that grows over time while having a random noise (Dixit and Pindyck 1994). The binomial lattice model can be used to capture the dynamic uncertainty about the retail price of electricity – denoted by R – in an approximate, discrete fashion. This modeling choice is consistent with the general body of knowledge in real options analysis (Hull 2008; Luenberger 1998).

In order to define a binomial lattice for the long-term retail price of electricity, a basic period length – denoted by Δt – is considered. For instance, Δt can be selected equal to *1* month or *1/12* year. Suppose that the initial retail price of electricity is R_0. At the beginning of the following period, the retail price of electricity is assumed to take just one of the two multiples of R_0: a multiple u (i.e., $u \times R_0$) for the upward movement of retail price of electricity and a multiple d (i.e., $d \times R_0$) for the downward movement of retail price of electricity. Both u and d are positive values while $u>1$ and $d<1$. The probabilities of upward and downward movements are $0 \le p \le 1$ and $0 \le 1-p \le 1$, respectively. This variation pattern continues for subsequent periods where the retail

price of electricity at the beginning of each period takes one of the two multiples of the electricity price during the previous period. The binomial lattice parameters *u*, *d* and *p* are determined by the following formulation (Hull 2008):

$$u = e^{\sigma\sqrt{\Delta t}}$$
$$d = e^{-\sigma\sqrt{\Delta t}} \quad (1)$$
$$p = \frac{e^{\alpha\Delta t} - d}{u - d}$$

where α is the expected annual growth rate of retail price of electricity and σ is the annual volatility of retail price of electricity. Historical electricity prices are used to estimate α and σ. A Monte Carlo simulation algorithm can be devised to generate several random paths for future electricity prices along the binomial lattice model.

Characterize Changes in the Implementation Cost of PV Systems over Time

The implementation cost of PV systems is expected to decrease over time. The decline of implementation cost may be due to several reasons including learning-by-doing, economies of scale, R&D expenditures, process/product innovation and input price declines (Hartley et. al 2010; Weiss et al. 2010; Yu et al. 2010). Experience curves can be used to characterize the cost reduction and efficiency improvement trends of PV systems over time. The changes in the implementation cost of a PV system can be modeled by a power function as follows:

$$C_t = C_0 X_t^{-\beta} \quad (2)$$

where C_t is the implementation cost at time *t*, C_0 is the initial implementation cost, X_t is the cumulative production of PV systems up to year *t*, and $2^{-\beta}$ is Progress Ratio (*PR*). Parameter β in this experience curve model can be estimated using historical data on implementation costs and cumulative productions of PV systems. An ordinary least square method is used to estimate β based on the formulation specified in Equation 2.

Identify the Best Time for the Implementation of PV Systems in Buildings

From the financial valuation perspective, a building owner, who considers investing in a PV system, can implement the system when the investment becomes profitable for the owner. In this sense, the owner holds a real option for implementing the PV system. The financial value of this real option must be determined considering the implementation time of the PV system. A risk-neutral valuation method for finding the best time for the owner to implement the PV system is devised. Risk-neutral valuation methods are developed in the mathematical finance to price options or derivatives by revising the probability measures of the underlying assets (Hull 2008). An adjustment process is needed to evaluate the investment options in PV systems using the risk-neutral valuation method. This adjustment facilitates the evaluation of investments in PV systems by allowing the use of the risk-free rate of return for discounting the stream of expected energy saving benefits. The adjustment process starts with revising the expected growth rate of electricity prices and deriving the risk-neutral expected growth rate of electricity price, which is calculated as $\alpha - \lambda\sigma$. In these adjustments, σ is the volatility of electricity prices and λ is the market price of electricity price risk. The risk premium of electricity prices λ as the underlying asset in the investment in PV systems is defined as follows: $\lambda = \frac{\rho - r_f}{\sigma}$

where ρ is the owner's expected return on investment in PV systems, r_f is the risk-free rate of return, and σ is the volatility of electricity prices. This adjusted, risk-neutral expected growth rate is used to calculate the risk-neutral probabilities of upward and downward movements in the electricity price binomial lattice model. At any node in the risk-neutral binomial lattice, the financial value of the immediate implementation of the PV system is compared against the financial value of deferring the implementation to the next period. The best time for the implementation of the PV system is when for the first time, the retail price of electricity becomes equal or greater than the respective minimum value of energy price.

Characterize the Financial Value of Properly-Timed Implementation of PV System

A probabilistic analysis method is devised that can be used to characterize the financial risk profile of the investment in the PV system considering the best implementation time as identified in the previous. The Monte Carlo simulation technique can be used to generate a large number of random sample paths for future energy prices across the risk-neutral binomial lattice model, which was created for the retail price of electricity in the previous Section. For each simulated path, it is determined whether the energy price becomes equal or greater than the minimum value of energy price and, if yes, when. This will be the best time for the implementation of the PV system. The investment in the PV system is evaluated based on this optimal implementation time. The implementation cost of the PV system occurs in the implementation time period and the stream of energy saving benefits follows the implementation. For each simulated path, the corresponding implementation cost and following energy saving benefits is determined. The difference between the sum of discounted energy saving benefits and the implementation cost is the investment value of the PV system. The risk-free rate of return is used as the discount rate in this risk-neutral valuation approach. The above valuation process for all randomly generated sample paths for electricity price is repeated and the investment value for each path is calculated. The result provides a range of possible investment values, as well as the likelihood of each investment value.

EXAMPLE

Suppose that the owner of a building located in Atlanta, Georgia, U.S.A. is considering the installation of a Crystalline Silicon Photovoltaic system. After installation, the PV system considered for this building is going to provide 7.7 KW (kilowatt) power and generate 12,000 kWh electricity per year that will be consumed in the building. An important aspect that should be considered when evaluating investments in PV systems is the decline of system performance over time due to the degradation of system components. Research (Vázquez and Rey-Stolle 2008; Dunlop and Halton 2006) has shown that the amount of energy produced by Crystalline Silicon PV systems decrease over time at an annual linear power reduction rate of .3% to 1%. For this example, it is assumed that the annual power reduction rate of this PV system is 1%. Based on the available market data acquired from industry sources (e.g., PVinsights website) the current purchase price of the entire PV system is assumed to be $4.7/W. The changes in the implementation cost of the PV system are modeled using the experience curve model. Using the industry projections, it was determined that the price of PV systems is anticipated to decrease every year due to experience curve effect (PR=0.46329). The initial price of electricity (year 2011) was

considered to be $0.10 per kilowatt-hour. The volatility of electricity prices was considered to be σ=10% per year. It was also assumed that the investor's risk-adjusted cost of capital or the discount rate ρ= 10 percent per year. Finally, the investment horizon was assumed to be 20 years. Under these circumstances, the real options analysis methodology was applied.

Figure 1 shows the probability distribution of the owner's NPV in case that he decides to implement the PV system immediately. This distribution shows the possible NPVs of investment in the PV system and the probability of their occurrences.

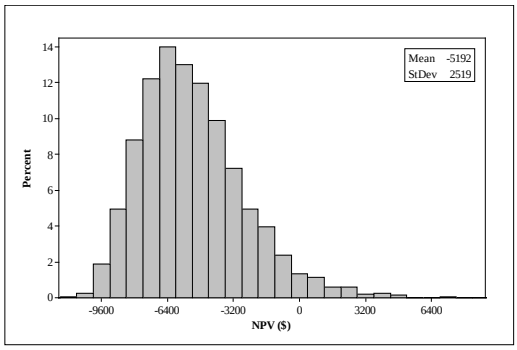

Figure 1. Probability Distribution of the Owner's NPV for Immediate PV System Implementation

Next, the proposed real options model is utilized in order to characterize the owner's risk profile in case that the PV system can be implemented at time during the investment horizon. This is followed by the identification of the minimum retail price of electricity, for which the value of implementation of the PV system exceeds the value of deferring its implementation to the following period and, therefore, triggers the implementation of the system. Thus, the best time for the implementation of the PV system is when for the first time, the retail price of electricity becomes equal or greater than the respective minimum value of energy price. Figure 2 shows these identified minimum retail prices of energy over the investment horizon.

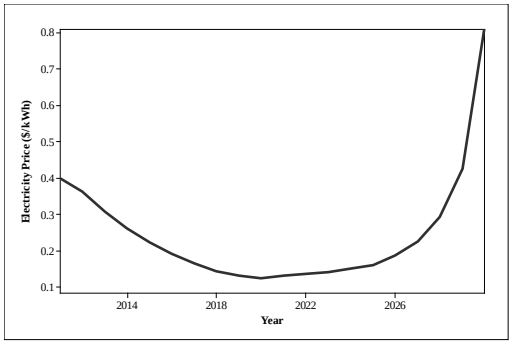

Figure 2. Minimum Retail price of Electricity that Triggers the Implementation of the PV System

Figure 3 shows the owner's financial risk profile (i.e. the CDF of the investment value) in case the implementation of PV system is properly timed. It also compares the owner's financial risk profile under this implementation option with the owner's risk profile in case the PV system is implemented immediately.

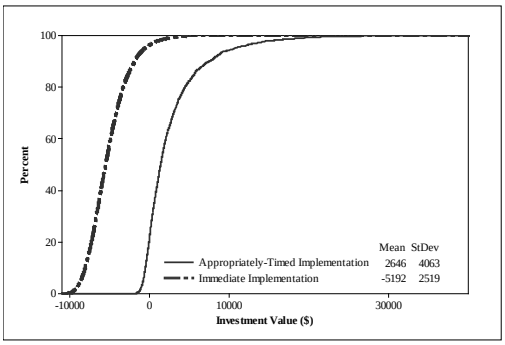

Figure 3. Owner's financial risk profile when the implementation is properly timed

CONCLUSION

The key element missing from existing valuation methods for sustainable investments in buildings is Optimal Investment Timing. The proposed real options model takes a different look at the problem of investments in PV systems for buildings. In this new perspective, a building owner with an opportunity to invest in PV systems holds an "Option" analogous to a financial call option – he has the right but not the obligation to adopt the PV system at appropriate time of his choosing. Our investment valuation model can be applied to find the optimal time for adopting PV system, as well as the financial value (if any) of delaying the implementation of PV system. Our proposed real options model is able to overcome the limitations of conventional investment valuation methods and most notably the NPV approach. It accounts for the uncertainty about respective energy saving benefits from implementation of PV systems and conducts trade-off analysis between their energy saving benefits and implementation costs. Based on this trade-off analysis, the proposed model identifies the optimal time to implement PV systems in buildings and characterizes the investor's financial risk profile under the uncertainty about energy saving benefits. Moreover, this real options model is capable of calculating the financial values of properly-timed investments in PV systems. Future research should be conducted to incorporate other sources of uncertainty, such as the uncertainty about decline in the performance of PV systems, in the valuation of investment in PV systems. This way better investment valuation models can be developed to help investors effectively implement PV systems.

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PUBLIC AUTHORITIES CHALLENGE TO IMPLEMENT ENERGY RENOVATION OF CONDOMINIUM BUILDINGS IN FRANCE

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ABSTRACT

In France in 2008, the "Grenelle de l'Environnement" Forum agreed and planned on energy renovation on private buildings to reduce greenhouse gases; the cost was estimated as hundreds of billion euros. Its implementation is actually more difficult than expected: in the absence of the obligation to renovate, public initiatives are required. Government strengthened incentive tax breaks, but they benefits mainly to the wealthiest individual home owners-occupiers. Public accompaniment of owners had always been necessary to improve residential co-owned buildings. Numerous local authorities helped them with the support of a national program first developed thirty years ago for social issues. Reducing carbon emissions recently became a new goal of the housing policies. This paper exposes a new device that French government has developed especially for energy renovation and that a few local authorities have experimented. It demonstrates that fight against climate change needs not only public grants but also local convergences with other aims and strong devices to convinced housing building co-owners.

Keywords: boundary object, housing improvement, mitigation, OPATB, thermal refurbishment.

INTRODUCTION

The residential and tertiary buildings represent 43% of final energy consumption and 23% of greenhouse gazes (GHG) emissions in France. Although this sector emits less as transport, it appears to be the best way to reduce French GHG emissions and, so, to mitigate climate change. Since 1975, the construction sector has adapted to successive reinforcements of energy regulation. Thank to a high thermal insulation, new buildings consume nearly ten times less energy than the average of existing buildings. This makes plausible a factor 4 (a 75% decreased in GHG) by 2050 if a substantial part of the current buildings stock will be renovated.

Housing represents the majority of the built surfaces. Private owners own 4/5th of all housings. The disjunction (Berdoulay & Soubeyran 2002) between the scale of the problem (global warming) and the decision scale (each housing) cannot be greater. The possible solidarity towards the planet from the owners will not be sufficient to reach the factor 4 in France; energy renovation requires governmental actions.

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The French government strengthened incentive market measures in 2005: the tax break is the main one. In 2008, the State spent therefore 2.8 billion € for 1.6 million households who spent themselves 8.2 billion € of work. This tax break benefited almost entirely (95%) to occupiers owners (57% of housing belong to occupiers owners and 25% to renter owners). Among the French households, the fifth wealthiest benefited six time more of tax breaks than the fifth poorest. Owners of single-family dwelling are overrepresented (56% of French housings, 81% of tax break beneficiaries) (Clerc & Mauroux, 2010).

The limits of tax break for housing improvement are known for several decades. During 70s, the Housing Ministry had implemented a grant device in partnership with local authorities: this device targeted non-occupiers owners and modest occupiers owners. It has often been essential for condominium improvement for a main reason: work decision requires a large majority of co-owners. Unlike tax breaks, partnership devices involve local governments during several years. At least, three levels of "government" are involved: national, local and, of course, condominium.

How these different scales of government integrate the issue of climate change mitigation? How mitigation policies should be implemented for the condominium buildings?

We assume that the content of mitigation policies is determined by involved organizations: not by one of them but by their interactions. Therefore, we consider partnership projects and multi-scale devices as boundary objects (Star & Griesemer 1989, Aibar & Bijker 1997, Trompette & Vinck 2009, Debizet & Symes 2009).

This paper focuses on the experimental partnership device developed by the state and applied by several local authorities in order to mitigation: OPATB device. The first part considers the OPATB device as a boundary object involving different ministries with their specific organization: knowledge, procedures and aims. The second part shows the high degree of investment of local governments and the interactions with territorial issues: it also illustrates the necessity to implement mitigation on a local scale.

OPATB AS A NATIONAL DEVICE FOR MITIGATION, COMBINING SOCIAL AND ECONOMIC ISSUES

Housing and Economic Ministries have overseen national policies relative to housing improvement. Climate change leaded the Ministry of Environment to promote building energy renovation. In absence of obligation to renovate, they developed together the OPATB device.

An obligation to renovate legally or politically difficult to set up

Since its inception in 1975, building regulation has established minimum energy efficiency; it applies only to new buildings, i.e. those submitted to an authorization procedure. Concerning existing buildings, an energy performance assessment must be associated since 2009 with the sale (or rent) of housing; however, it only informs the buyer (or tenant). In addition, minimum performances of products are imposed on professionals: i.e. when they replace windows.

In 2007, the mitigation of climate change was one of the main issues of the French presidential race. Incumbent President Sarkozy avoided specific commitments, but vowed a broad consultation on the environment and climate change. During the "Grenelle Environnement" of the Forum, all participants agreed to mandatory energy renovation of buildings. However, a few months later,

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the "operational building committee" was reluctantly argue about the solvency of owners and the difficulty in defining the verifiable obligations. Laws that apply the "Grenelle Environnement" does not actually impose a general obligation. In the absence of requirement to undertake energy renovation, incentive provisions have been promoted for several years and shall be developed for may years.

Preexisting economic incentives for owners

With 1.5 million jobs, the construction sector is one of the country's first economic sectors. As such, tax cuts for individual investors and zero-interest loans have sustained construction. Progressively, French government strengthened these incentives in case of energy efficiency work.

Tax cut and loan subsidies have always been insufficient to stimulate the landlords and modest homeowners. The former do not benefit directly of energy savings. The latter have little capacity to finance work. These two categories can receive grants from the national agency for housing improvement (Anah). Created by the State in 1971, Anah *"encourages and facilitates the execution of improvement work and housing adaptation."*

In 2008, Anah distributed two thirds of the 526 million euro of grants within local scheduled operations of housing improvement (OPAH: Opérations programmées d'Amélioration de l'Habitat). Specifically, local authorities increase the fund and define the perimeter, the goals and some grants level in consultation with Anah. Finally, the owners receive more grants than Anah usually gives outside of an OPAH perimeter (Anah 2009).

The first scheduled operations were signed with local governments in 1977, as part of urban renewal of neglected and unhealthy historic districts (Gravejat 1991). Gradually, Anah has expanded the device to economic and social aims. During 90s, energy savings appeared progressively as a lever of housing improvement.

Before partnership convention, pre-operational studies clarify the scope, work types and calibrate both subsidy levels and partners financial budget. The subsidy rate should be high enough to trigger reinvestment from private actors and low enough to respect the budget of each partner. The result is uncertain because owners (or condominium corporation) actually choose the work and, therefore, decide whether or not to use the subsidies.

OPATB national device genesis

Ministry of Housing (supervisory authority of Anah) and the Ministry of Environment (supervisory of Ademe) introduced OPATB device in February 2002 as a call for local authority projects. *"The OPATB are intended to act locally on residential and commercial buildings to reduce their energy consumption and CO2 emissions"* (Ademe & al. 2002) The OPATB device actually fitted into the mold of Scheduled Operations of Housing Improvement (OPAH) that have proven efficient since their creation in 1977 by Anah. However, the principles of call for project and the criteria to select communities correspond to Ademe procedures.

Agency for the Environment and Energy Management (Ademe) implements environmental policies carried by Ministry of environment. It also offers its expertise to local authorities. Ademe calibrates its devices to bring out innovative experiments and facilitate its diffusion. Then, national or local governments often contribute, by grants or tax cuts, to the diffusion of a sustainable innovation initially funded by Ademe.

Ademe considers OPATB (operations rather than the device itself) as innovative experiments: "*The multiplicity of targets must create genuine competition among professionals and increase synergies [...] between building partners".*

Ministries validated the OPATB device. They ensured compliance guidance to key moments and the communication fallout. Then, Anah and Ademe have implemented the device in partnership with local governments:

- Anah fulfills its mission: aid landlords and modest tenants. It masters the operational methods: targeting buildings, defining scope and ways of grants...
- Ademe funded energy studies, technical animation, final evaluation and some high performance work. It manages also the experiences exchange network.

Ademe and Anah envisaged twenty-six local OPATB: "The *future multiplication of OPATB depends on the success of these first OPATB.*" Only 16 OPATB were underway in 2007. However, a growing number of OPAH incorporates "energy" as one of their goals: 273 of 715 ongoing OPAH in 2009.

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During the OPATB device gestation period (2000-2002), Ministry of Housing (Besson 2000) appropriated the goal of climate change mitigation (targeting global solidarity) in addition to initial goal of saving energy (targeting the purse of owners and occupiers). OPATB device hybridizes OPAH (Anah) and innovation funding (Ademe), it finally encourages Anah to develop energy goal in the OPAHs. Ministry of Environment and Ademe increased their legitimacy and their visibility on the housing sector. OPATB device appears as a transient boundary object between the sectorial Ministries and between their agencies.

Let us observe how the OPATB device implements the mitigation on a local scale.

GRENOBLE AND ECHIROLLES OPATB

Six of the thirteen OPATB operations implemented in 2006 were located in the Rhône-Alpes, one of the most dynamic regions in terms of sustainable building (Roudil & al. 2008). We choose the cases of Grenoble and Echirolles because these OPATB mainly concern condominiums. Anah and Ademe selected Grenoble in 2002 and Echirolles in 2004.

After describing the OPATB process, we explain how local authorities approach OPATB. Then, we summarize the results of Grenoble OPATB .

A lengthy and complex implementation: i.e. Grenoble OPATB

Three years were required to define the Grenoble OPATB (two years for Echirolles). The implementation convention, signed by Ademe, Anah, the city of Grenoble, the State and Grenoble Alpes Métropole (the metropolitan authority) in October 2005, described the quantitative targets, the financial commitments, the subsidy rules and the terms of animation, monitoring, evaluation and control.

Once signed the partnership convention, the operational stage began with a long and tedious work of information to storekeepers, condominium boards and managers in order to encourage them to initiate an energy audit. After its energy audit, the

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condominium board was accompanied for one or two years until a majority of co-owners votes (or does not vote) for thermal work during the annual condominium meeting.

When many boards of condominium planned to propose energy renovation at their annual meeting, the city left proactive communication. It avoided to involve new condominiums and, therefore, to exceed the OPATB budget.

The figure below illustrates the process. The city ("Ville de Grenoble") steered the OPATB process and the condominium board ("copropriété") steered the building renovation project. During work, city subsidized 20% of work cost to the condominium. The housing owners received subsidies based on their individual situation.

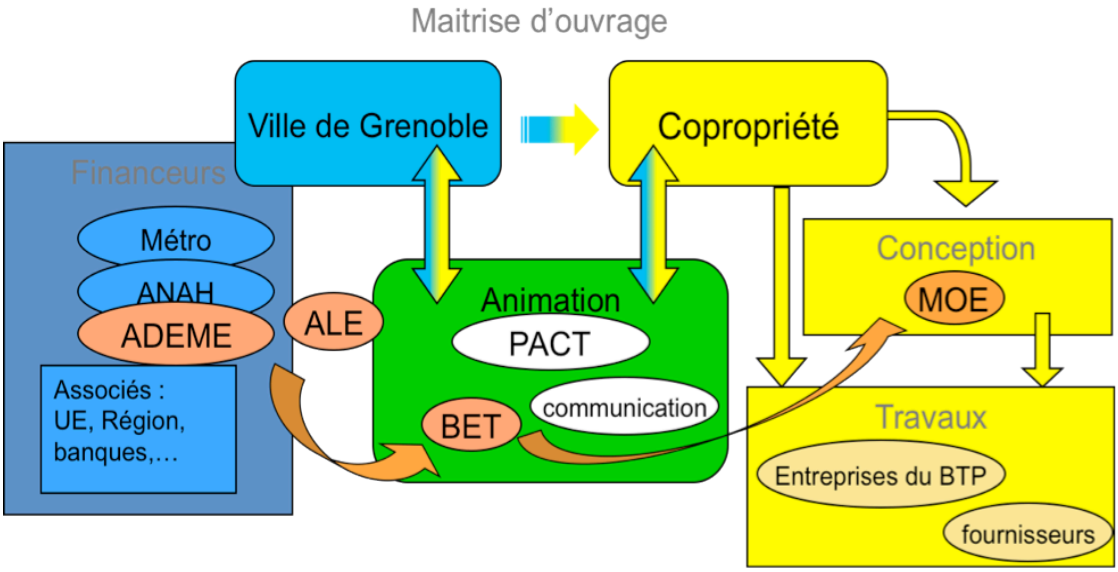

Figure 1 OPATB Grands Boulevards process. (Source: Debizet based on figure of Carré, PACT de l'Isère 2009)

Funded by the signatories of the OPATB agreement (blue or dark gray), the animation device (middle) aimed condominiums (green or light gray) to drive the energy renovation project: each condominium recruited a contractor. Each category had a technical expertise (orange or gray): this facilitated the knowledge transfer to architects ("conception") and contractors ("travaux") and the control of thermal performances by Ademe.

OPATB animation combined the contribution of technical, organizational, financial and communication experts. A non-profit association (PACT), specialized in assisting housing improvement, coordinated the animation team.

City of Grenoble: an urban project became an illustration of the energy-climate local policy

At the stage of pre-operational studies, perimeter covered a band of four hundreds meters around the new tramway lane through the city. Three kinds of building were targeted: tertiary public buildings, small shops and condominium housing. The scope of these last two had been restricted. The 'Small shops' only concerns facades along the new tram lane (orange line below). The perimeter "Habitat" (green line below) applies to all blocs along the tram lane (green line below).

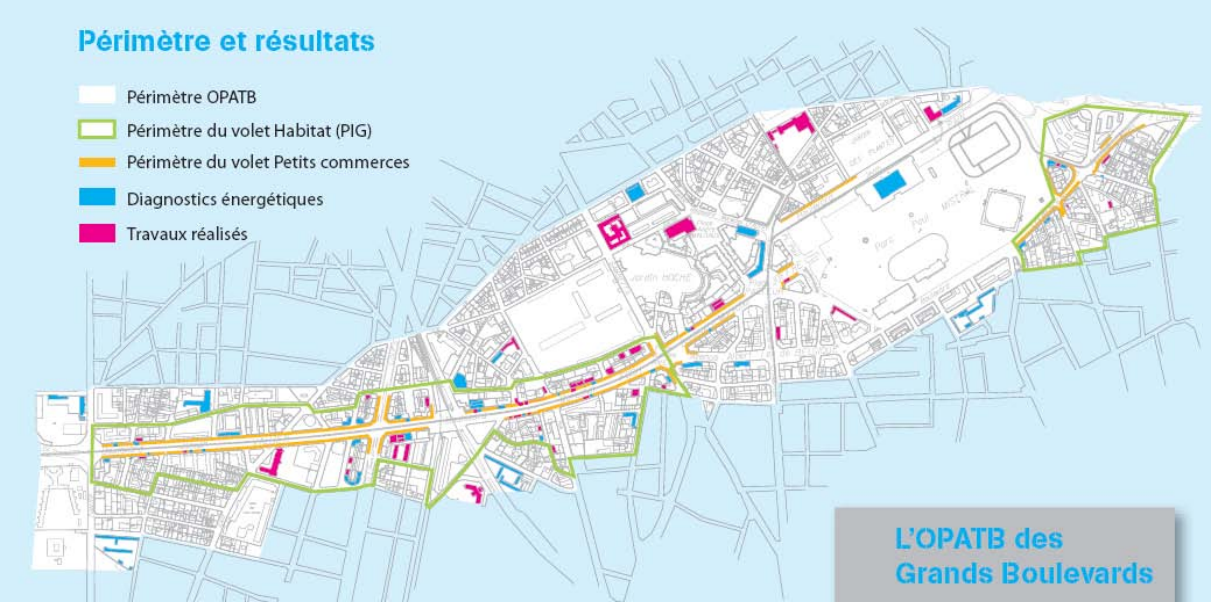

Figure 2 Perimeter and and results of Grands Boulevards OPATB (Source City of Grenoble : OPATB assessment)

Realized where fortifications protected Grenoble city center until 1938 (Parent 1982), the Grands boulevards are currently lined by tall buildings built between 1945 and 1967. Their energy performance was poor.

Several major urban projects concerned this area: highway bridge demolition, new tram lane, traffic calming measures, building facelifts and also building a green district nearby (De Bonne). The city council expected to reduce urban break between the wealthy historic center and the suburbs built during the post-war boom.

"*The intervention on the Grands Boulevards is part of a global project of territory conquest and transformation.*" explained the mayor in the 2006 brochure of the OPATB addressed to the inhabitants. It also supported the tram lane success, which some storekeepers opposed. The brochure advertised three aims: revitalizing the shops, improving buildings thermal performance, and enhancing architecture. OPATB's slogan "new air on the Grands Boulevards" exalted the aesthetic as much as climate.

Three years later, in 2009, the tramway lane was so popular with inhabitants and most of the storekeepers, that the ideal of urban continuity became useless. Now, apart from technical communication to owners, the city exposes OPATB as a flagship project of its "Grenoble Factor 4" program. "Grenoble Factor 4" is de facto the Municipal Climate Action Plan and a new ideal for the city's future (Henry 2008). The renewal of the City Council in 2008 confirmed this trend by moving the OPATB political leadership: the deputy mayor in charge of Sustainable Development replaced the deputy mayor in charge of Urban Development.

City of Echirolles: OPATB as an action of the sustainable development program complementary to major urban projects

Second town of the Grenoble urban area, Echirolles has been urbanized since 30s. In the 60s, social housing and condominiums buildings had started to grow alongside the working-class individual house area around main industrial sites. For the last twenty years, the city has built a true urban center around a tramway lane, which is the communal territory epicenter. Ten years ago, the city council launched an Agenda 21. It has mobilized residents and city staff around shared objectives by focusing on social

and environmental synergies. It took care to cover all areas of the city and, both, the diversity of sectorial thematic and the different categories of people. Since then, it has led to systematic follow-up actions with the residents.

Figure 3 Perimeter and posters of West Echirolles OPATB. (Source: City of Echirolles)

The OPATB "Echirolles West" conveniently filled the hollows of Agenda 21 and of a vigorous urban policy. First, the western districts did not benefit from the public facilities of the Echirolles city center. Second, the various actions on buildings conducted by the city did not relate to existing private buildings. The western districts focused on the higher proportion of private housing (mainly condo) and weaker political relays of the city leftist majority. Compared to Grenoble, OPATB communication emphasized household interest and, implicitly, global solidarity but it ignored the urban dimensions.

Grenoble Alpes Métropole, the metropolitan authority: embrace a new skill

Partner of Grenoble and Echirolles OPATB, the metropolitan authority (commonly called "The Metro") abounded them on its own budget. This institution is in charge of metropolitan transport, economic development, social housing and some environmental issues (atmospheric pollution, road noises, waste...) but not urban planning. The Metro created in 1999 the Local Energy Agency, which provides expertise and advice to local partners, businesses and residents. The Metro was one of the first French Métropole to develop a Local Climate Action Plan (presented in May 2005). It introduced early the climate change mitigation goal in its housing and transport policies, and mobilized the cities of the area to develop climate policies (Debizet 2009). It steers the "Mur Mur" device that succeed to OPATB from 2010.

Restricted to an animation and incitement in urban planning role, the Metro will initiate and facilitate innovation in the building industry that remains one of the main economic sectors and provides the majority of the metropolitan taxes.

Minor contributors to both OPATB operations

The **Rhône-Alpes Region** funded energy audits and some solar water heaters or photovoltaic panels. In addition to GHG reducing, the action of the Region has been

part of an economic development of solar and green building sectors (Roudil et al. 2008). Non-signatory to the OPATB, the Region did not participate in their targeting.

Under the European Concerto program, **European Community** funded a tenth of the OPATB animation. This funding was acquired several months before signing the partnership convention; City of Grenoble might make choices more vigorous.

Results of Grenoble OPATB

When Grenoble OPATB period (2007-2010) ended, a quarter of eligible condominiums (22 condos grouping 637 apartments) had decided to realize thermal improvement work. Unlike previous OPATB partnership convention, their work consisted almost entirely in adding external insulation. OPATB granted 1.6 million € of the 5.5 million € work and spent 0.6 million for animation and expertise (Debizet 2010).

Grants represented 30% of work cost for an average owner. However, this rate depended on owner status and income. It varied from 35 to 80% for non-occupiers owners (landlords) and from 20 to 80% for occupiers owners. These rates did not only result of social issues. They were required to find a majority in favor of energy work during the annual condominium meeting:

- Because national law restricts the rent increase, landlords do not benefit of energy renovation when they keep the housing. Therefore, they need grants to maintain profitability of investment. Among them, the less wealthy and the older have to be helped because they cannot get a bank loan.

- The poorer and the older occupiers owners have also to be more helped. First, they cannot benefit of tax breaks and bank loan. Second, the profitability of their energy renovation investment is lower than that of the wealthiest occupiers owners because their initial energy bill is low (they already try to save energy).

Owners can also benefit from national tax breaks on the balance after OPATB grants. Failing of specific statistics, we assess that tax breaks represent roughly 10% of the global work cost. According professionals involved in the OPATB, tax breaks are not decisive for modest owners.

The Grenoble OPATB helped reduce annual carbon emission of 575 tons. Therefore, energy renovation cost 10,000 euros to reduce annually one ton of carbon: OPATB partners (including state) funded directly 4,000 euros and state funded 1,000 euros through tax breaks.

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Local authorities consider OPATB as an opportunity for a wider project (or policy): sustainability program (Echirolles), urban project or climate plan (Grenoble). The specific priorities of local governments influence perimeter and targeted population. Anyway, the initial convention and the partnership steering committee ensure that the implementation respects the aims of mitigation and energy saving. We missed place to describe the cognitive and organizational aspects. The concept of boundary object could also be useful to describe the interactions of local governments and national agencies especially in order to analyze the outstanding issues of energy renovation policies.

CONCLUSION

The energy renovation appears a consensual mean to reduce GHG emission. However, it requires a high level of investment. The wealthier occupiers owners of individual

dwelling can expect a financial gain thank to energy saving; they benefit easily from tax breaks and are able to quickly decide insulation work. The collective housing owners do not have the same abilities. A local accompaniment is necessary; it combines variable grants and a socio-technical mediation.

Unlike one ministry, local authorities consider the scheduled operations of energy improvement as a transversal element to their different policies. They will have to face the antagonism between mitigation and social goals (Debizet 2011). Maximizing GHG emission reduction of a given budget leads to orientate public funds toward the wealthier condominiums.

On another scale, French government should adjust the rate of tax break according household income and dwelling type. It should also increase the part of scheduled operations within its overall budget available for energy renovation. Anyway, it cannot avoid the debate between mitigation goal and social priorities. Further analyzes of the local implementations of mitigation could feed this debate.

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PUBLIC ENGAGEMENT AND PARTICIPATION IN SUSTAINABLE TRANSPORT ISSUES

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ABSTRACT

Currently, emissions from transport represent a quarter of Scotland's total. While the Scottish Government has identified a number of transport policies, which would contribute to Scotland's ability to meet its targets, action to significantly reduce greenhouse gas emissions from transport has been limited, poorly integrated with other areas of policy, and focused on narrow programmes. Drawing on best practice from cities across the North Sea Region, this paper considers how public engagement can be utilised within the development of holistic low carbon urban development. Consideration of regions where strategies have been successful reveals a context where transport is considered as part of wider urban design and urban development, thus ensuring that the potential benefits are directly related to concerns of planning, housing and behavioural change. The paper includes information and conclusions from a case study in Aberdeen, Scotland.

Keywords: participation, climate, regional, transport, urban.

INTRODUCTION

In the coming years, urban areas across Europe will increasingly be required to respond to the challenges of climate change. To date, this has been reflected in numerous European directives and initiatives, including those within the Strategic energy technology plan (SET), the smart cities initiative and CIVITAS. Within these initiatives has been a recognition that decisions made in the planning and management of our cities will have direct and often complex implications for the environment. A central part of the underlying philosophy is an understanding that such complexity extends across the built environment, infrastructure, transport provision and human behaviour. The research reported in this paper considered how the development of sustainable urban transport strategy can benefit from the direct implementation of strategies to engage end users. Particular challenges relate to the balance between spatial planning, consumption and behaviour, and the development of new and extended urban centres. Indeed, it is clear that behavioural change will be central to

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meeting climate change targets, thus suggesting that participation of users at the design stage carries potential to greatly improve end results and modal shift.

In response to concerns about climate change, air quality and sustainable development in general, local governments around the world are facing challenges to develop and implement carbon reduction initiatives. The challenges they face are daunting for many reasons that are well documented in the literature. Barriers to policy implementation include: limited resources for developing new infrastructure and services, institutional and policy barriers, social and cultural barriers, legal barriers, unintended consequences and side effects (Banister 2005). There are, however, examples of best practice where cities have developed effective carbon reduction initiatives and numerous projects have been developed to try to transfer knowledge and best practice between local governments.

This paper draws on experiences from CARE North, an Interreg-funded initiative (IVB North Sea Region Programme) aiming to develop *'a comprehensive, strategic and practical approach to urban and regional transport accessibility in the North Sea Region'*. CARE North extends across 9 partners and 4 countries, and includes input from ICLEI, an association of local governments committed to sustainable development. The project was initiated in response to concerns about climate change and recognition of the need to reduce transport-related CO_2 emissions which continue to rise (despite per-vehicle emissions falling) and pose a significant threat to health. The northern European region is interesting in that, whilst there are partially shared climatic and cultural contexts (particularly in the Nordic and Celtic countries), the rate at which sustainable transport has been adopted across cities and regions varies greatly. For example, Bremen, Germany (see Figure 1) has implemented an extensive network of bicycle share hubs, which help to normalise the use of low carbon transport across the city. Coupled with an extensive tram network, use of the city centre for many is aided and defined by the ease with which pedestrians and cyclists are able to share the space with motor vehicles. An early pioneering city with regards to a shift towards walking and cycling was Copenhagen, Denmark, which today is arguably defined by its fully integrated walking, cycling and rail networks, including an expanding underground system (Figure 2). The success of such schemes lies in the demonstrable shift in modal share between walking/cycling, use of public transport and car use. Of great importance, also, is the manner in which the schemes have been designed to integrate with daily lives, rather than to demand radical shifts in lifestyle. Therefore, in addition to institutional and political challenges, there are challenges of public engagement that must be taken into account. Transport policies can be very controversial, especially if they attempt to change travel behaviour by restricting access or increasing cost. It is therefore considered essential that members of the public are engaged in the process of the development of such initiatives. ‘Overcoming barriers to effective implementation requires interactive and participatory processes, so that intentions and outcomes of policy interventions to achieve sustainable transport coincide.’ (Banister 2005)

However, as reported in the literature, there are great challenges of transferring carbon reduction initiatives between cities. Initiatives that are successful in one area will not necessarily be successful when transferred to other cities for many reasons. (Marsden et al. 2010) recommend that local governments need to develop a culture of learning from others which takes into account all aspects of the implementation of the initiatives but that that learning should 'be approached with scepticism about the full scale and transferability of benefits'.

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Figure 1 – Bremen bicycle share scheme ‘hub’

Figure 2 – Entrance to new underground station, Copenhagen

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CONTEXTUAL REVIEW

Public engagement and participation

A dimension related to the successful adoption of carbon reduction initiatives in local authorities is public participation and engagement. Local authorities have a statutory duty to consult citizens and public engagement through Community Planning Partnerships forms a core part of the Single Outcome Agreements between the Scottish Government and Local Authorities. Participatory initiatives are believed to help overcome public disengagement with politics (Dalton 2004). Public participation is believed to: increase the accountability and transparency of government institutions, broaden the base of political participation and create more active and engaged citizens (Smith 2009). Participative policies are also believed to play a role in educating the public and increasing civic awareness (Darier & Mehta 1998).

As well as having a positive impact on the legitimacy of policies and decision-making it is also argued that public participation initiatives such as 'planning for real' may have a positive impact on the policies themselves making them more suitable to the needs of the people than policies devised at the local authority level (Smith 2005). The role of participation is seen as being more than just creating effective policies, however. There is also a broader issue of engagement that is being sought to overcome the problem of the democratic deficit and apathy towards politics within the general public that is perceived to be occurring at the local level in order to make the institutions of government more responsive and legitimate (Chandler, 2000).

As demonstrated earlier in the paper, however, the aims of public participation go beyond policy development and also have educational and broader goals of engagement which cannot be measured in policy outcomes. In order to effect behavioural change it is argued that people must understand the impact that their choice in transport is having. (Bickerstaff & Walker, 2001) investigated the way that the public perceive air quality issues and found that people tend to have a highly localised view of air quality which draws on physical and spatial criteria as well as cultural and economic factors.

Policy context

One of the big challenges for trying to analyse how transferrable a carbon reduction initiative will be from one local government to another is the policy context. There are multiple layers of interconnected government in the UK which all have a bearing on transport policy and are themselves influenced by European and International level treaties and laws. An excellent analysis of Multi-Level Governance for carbon reduction policies in the UK was conducted by Marsden & Rye, (2010) who identified the limited sphere of influence that local authorities have:

"The main policies for local carbon reduction which authorities have control over are parking allocations for new development, smarter choices and improvements to walking, cycling and public transport (bus) infrastructure." (Marsden & Rye 2010)

Financial restrictions place further limitations on local authorities' work which has an impact on their ability to implement carbon reduction policies, especially if these involve investment in infrastructure etc. There are strict rules on local authority spending and limitations are put on the raising of council tax. The Scottish Government, for example, has frozen council tax for the duration of the 2011-2016 parliamentary period in keeping with the SNP manifesto pledge (Bell 2011).

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Urban context

Everyone makes daily decisions about where to go, how to get there, and what to do when they arrive. The perceptions of quality and safety of the spaces involved will influence many of these decisions and activities (e.g. the safety and attractiveness of routes travelled to and from work or school etc.). Therefore, the quality of public space and urban streets is important. Oxford Brookes (ODPM 2002) note that typical concerns relating to public spaces may include unsafe streets and public spaces that foster anti-social behaviour, crime and the fear of crime; dirty streets and public spaces; and, unattractive and inaccessible parks, play areas and open spaces with poor provision for children and young people, older people and disabled people. Rather, the buildings are important specifically because of the manner in which, even at a small domestic scale, they serve to provide evidence of the history of the societies and cultures from which they emerged. Therefore, it can also be argued that the value of our cities extends well beyond concepts of financial value (e.g. in a cultural context, Shipley 2000), and that choices made regarding the relative positioning of the pedestrian within cities will greatly define the public realm (e.g. Gehl 1987, Gehl and Gemzøe 2006).

CASE STUDY: ABERDEEN

Aberdeen is the third largest city in Scotland with a population of approximately 216000 people. The economy of the city has been boosted considerably by the North Sea oil and gas industry which has to a large extent insulated Aberdeen from the global economic recession and has contributed to Aberdeen having a very low unemployment rate and a higher than average wage rate for Scotland (Aberdeen City Council 2012). Car use in Aberdeen City is high with 42% of residents reporting that they use a car every day compared with the Scottish average of 33%.

The key policy document for understanding Aberdeen City Council's transport document is the Local Transport Strategy which sets out the vision for ACC's strategic plan for the city's transport infrastructure and services until 2012. The plan recognises that there are significant problems with congestion and air quality in Aberdeen (Aberdeen City Council 2008) but indicates a high level vision to develop a sustainable and accessible transport system, which a vibrant economy and minimises the impact on the environment. The strategy makes specific mention of carbon reduction initiatives including: reducing the need for council staff to travel, encouraging lift sharing, developing car clubs and encouraging the introduction of low emissions vehicles. The strategy is closely linked to the Air Quality Action Plan which aims to reduce the problem of poor air quality in Aberdeen City Centre (Aberdeen City Council 2011).

SURVEY AND RESULTS

In order to study public responses to a range of local proposed initiatives, an online survey was run to gauge levels of support and reaction. The total response rate to the CARE-North questionnaire was 627 which could be considered a good response rate to a public engagement questionnaire.

It was found that the vast majority of respondents regularly travelled in to the city centre with 73.7% indicating that they worked in the City Centre, 32% indicating that they live in the city centre and 77.3% indicating that they travel in to the city centre for shopping and or leisure reasons. Only 3.8% of respondents indicated that they never travel in to the city centre.

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Mode of transport used by respondents

In keeping with the high levels of car ownership within Aberdeen itself it was found that 86.1% of respondents reported having one or more cars in their household. It was found that travel by car was the most frequently reported mode of transport used by respondents for journeys in to the city centre across a range of activities including: travel to work/school/university, leisure activities during the day, leisure activities in the evening and shopping. The second most frequently reported mode of transport was walking followed by the bus. These results were also reflected when respondents were asked to rate the relative ease of travelling in to Aberdeen City Centre. Respondents were asked whether they considered that Aberdeen City Council had a good active travel network including walking and cycling (promotion of active travel is one of the ambitions of the local transport strategy). The majority of respondents (52.5%) disagreed or strongly disagreed with this statement with only 2% strongly agreeing with this statement.

Respondents were asked to rate a range of factors to determine their relative importance in terms of influencing their decision to use public transport. The factors that were most likely to influence respondents' choice to use public transport were:

- Reliability of the service
- Frequency of the service
- Cost

Respondents were then asked to rank a series of factors in terms of how they dictated their choice of transport. In keeping with previous responses it was found that convenience was the main factor that influenced choice of transport, followed by reliability, time taken and cost. Environmental concerns were rated as the lowest concern amongst respondents.

To determine whether the local transport strategy matched with public beliefs about priorities for transport, respondents were asked to rate the importance of the priorities. It was found that all five priorities were rated as important or very important by a majority of respondents with 'Safe and Secure Transport' ranked highest followed by 'Minimise the environmental impact of transport'

Awareness of air quality issues

Respondents were provided with information about the air quality issues in certain areas of Aberdeen and were asked whether they were aware of these issues. 36.7% of respondents indicated that they were aware of air quality issues with a further 27% indicating that they were partly or possible aware. 36.2% of respondents indicated that they were not aware.

Respondents were then asked about how concerned they were with regards to their health or the health of their family about the level of pollutants. In total 48.1% of respondents indicated that they were concerned or very concerned about these issues.

Respondents were then asked about the extent to which they considered different issues were contributing to air problems. The factor that was considered to be of greatest concern was pricing of public transport, followed by congestion. Connectivity of different modes of transport was also considered to be a significant factor as was the routes that public transport take.

Initiatives

It was found that 64.7% of respondents indicated that they supported the idea of a low emissions zone in Aberdeen City Centre. Of those who supported the LEZ, 93.9% indicated that Lorries should be restricted/discouraged, 59.4% indicated that cars should be restricted, 20.3% indicated that taxis should be restricted and 19.3% indicated that buses should be restricted.

Respondents were asked whether they believed that the introduction of car clubs would reduce the number of cars in Aberdeen City Centre. Approximately 35% of respondents indicated that they believed they would, 32% indicated that they would not and 33.3% indicated that they did not know. 19.4% of respondents indicated that they would consider joining a car club.

Results from the survey are interesting at a local level, as they demonstrate a genuine interest in the impact of transport and choices on the environment, with broad public support for a range of initiatives. The earlier part of the paper, though, indicates that cities where initiatives have been implemented on a wide scale, that this has been integrated in a holistic approach to city development. Local policies to address issues of transport in the city and region are in place, and can arguably draw on such indicative public support to move from planning to implementation.

DISCUSSION AND CONCLUSIONS

This paper has described contextual and applied research undertaken across the North Sea Region, with particular regard to the integration of public engagement and wider concerns over sustainable urban transport. The importance of understanding the relationships between urban development, and issues of transport, user choice and human contact has been studied previously (for example, van den Berg 2011, Marchal and Nagal 2005). Similarly, the subject of spatial development (e.g. development of new towns) and how this can integrate with and support sustainable choice with regards to transport (Dijst et al. 2002) will become increasingly important to strategies within Scotland in the coming years, as pressures increase on urban density. It will be important for cities such as Aberdeen to recognise that new housing must be integrated with viable sustainable transportation, as is the case in CARE North partner city Gothenburg, for example. The research ultimately calls for an holistic approach to urban development, which recognises the integrated importance of robust policy, user participation within design and strategic development and a recognition of the importance of behavioural change, in addition to the provision of new infrastructure.

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WOMEN IN SOUTH AFRICAN CONSTRUCTION INDUSTRY: INVESTIGATING THE FEMININE FOOTPRINT FURTHER

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ABSTRACT

Research presented in the paper updates the analysis from a previous paper, which was presented at COBRA 2010, in Paris. The situation with women and work in Apartheid South Africa was very discriminatory. Post-apartheid laws and policy frameworks for emancipation of women are supposed to create an enabling environment for women, especially with regard to labour issues. However the situation with women and work in South Africa is still below set goals. Using the construction industry as context of study, an updated picture of women and work in the local context is presented. A purposive sample of literature related to women liberation especially in the work place, and women in construction in South Africa is utilised. Literature review is complimented with analysis of local labour statistics, which makes use of secondary data from South African national labour force surveys. Findings show that women in construction in the local context are still concentrated in non-professional and non-technical work types.

Keywords: Construction, development, employment, gender, women.

INTRODUCTION

Research interest for the paper concerns the effectiveness of the gender-positive environment created as one of the outcomes of South Africa's democracy of seventeen years. Specific focus is given to the employment situation of women in the local construction industry. Following from previous research work, an updated study exploring the highlighted issues further is presented.

South Africa has a history of strong racial and gender conflict, and oppression. Since 1994 the nation entered into a democratic era in which the collective impact of previous dispensations is still prevalent (Government Communication and Information System (GCIS), 2011). Gender main mainstreaming policies in relation to employment and promotion of women only came into existence after inception of

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democratic rule (The South African Department of Labour, 2010). Therefore it is arguable that apartheid era South Africa, had enabling environment for high occurrence of gender based discrimination in the work environment. It is also arguable, that gender mainstreaming interventions instituted in post-apartheid South Africa, would address inequalities of the past. Thus effectiveness of the new gender-positive environment could be measured through women empowerment. Critical areas include race and education, in relation to employment and promotion of women.

RELEVANT CONCEPTS IN THE STUDY

Theory discussed here centres around women liberation in Africa and South Africa in particular. Issues relating to Women employment are centred about the intersections of feminism, women and work, gender and development. Specific focus on women employment issues in the local construction industry also concern Human Resource Management (HRM) policies, legislations and implementation.

Feminism

History of Feminism is notable in Europe and America, where initiatives have been taken against marginalization of women since the nineteenth century. There have been three waves of feminism. Consequently the following issues have been addressed: women's rights to education, employment, property rights, women's suffrage, economic rights, as well as sexual and reproductive rights (Karl, 1995); social and legal norms that affect women (Rowbotham, 1996); ending institutionalised oppression of women; empowerment of women for participation in decision making at all levels of society; and transformation of society through women's participation and perspectives (Karl, 1995).

Gender and Development

The Gender and Development (GAD) concept emerged from the 1985 United Nations (UN) Women's Conference in Nairobi. GAD focused on issues of subordination in social relations between men and women (Pearson, 2000). The major outcome of GAD is the promotion of women's advancement nationally and internationally. The following events took place with landmark outcomes: world conference on Equality, Development and Peace in Mexico, 1975; the decade for Women and Development, 1976-1985; appraisal of the 1975 world action plan for women advancement in Copenhagen, 1980; International treaty on Convention on the Elimination of All forms of Discrimination Against Women (CEDAW) in September 1981 (UN, 1995); and the emergence of 'Forward Looking Strategies for the Advancement of Women' (FLS) in Nairobi, 1985 (Jahan, 1995). Furthermore the Beijing conference of 1995 resulted in a declaration, which addressed critical areas of discrimination against women including, education (Kvinna Till Kvinna Foundation, n.d.). The above mentioned developments have had positive impact on the advancement of women, with the emergence of new challenges. Research shows that the feminine footprint in the labour market has increased globally. However the increasing population of employed women experience poor work terms and conditions (United Nations Research Institute for Social Development (UNRISD), 2005). Possible inferences at this point include: that women are less paid; women are fewer in professional, technical and managerial types of work; and that women do not enjoy succession to higher levels of work or pay.

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Women and Work

With regard to work, women's effort could be grouped into reproductive work, economically productive work, and community managing work. These groupings respectively refer to women's biological roles for children and family; work done in exchange for payment in cash or in kind; and the mostly voluntary or unpaid community management work. In contrast, most work undertaken by men for the general good is usually rewarded in some way (Moser, 1993). The suggestion here is that there are culturally embedded perspectives with regard to gender and labour. Furthermore there could be fundamental differences in perceptions and management of human resource across human cultures.

Human Resource Management

Human Resource Management (HRM) could be seen as influencing the employee population of an organisation, different from the organisation's ownership (Wojtkiewicz, 1985). More recently HRM is described as the procedure for achieving balance between growth and development for any organisation; and the same for its employees, within the organisation's capacity (Grobler et. al., 2006). HRM is essentially aimed at improving effectiveness of employees in an organisation (Heneman et. al., 1986). The process of HRM moves from policy to practice. As such policies are developed, interpreted and then implemented (Grobler et. al., 2006). The advent of globalisation has impacted the practice of HRM appreciably. Recent developments include global expansions of companies; mutual awareness of cultural differences; Asian economic growth; outsourcing of production to less developed countries; impact of information and communication technologies; labour issues such as leave allowances, remunerations and compensations (Friedman, 2007).

The South African Case

Since cultural peculiarities and history are strong influences on women and work; it is arguable that African countries such as South Africa have good grounds for women liberation issues. Across the African continent there are records of African women leaders of resistance movements, starting from the 7th century. Examples include the Berber Queen, Kachine of the Maghreb; 9th century Magajiyas of Daura; 16th century Queen Amina of Zazzau; and 19th century Nehanda of Zimbabwe. Moreover, early 20th Century has records of Igbo (Ibo) women leading resistance in the Aba women's riots (Oxford University Press 'OUP' blog, 2007; Net Industries, 2010; Trask, 2004). In South African history, prominent women activists include Charlotte Maxeke, Lillian Ngoyi, Albertina Sisulu, and Winnie Madikizela-Mandela (Mlambo-Ngcuka, 2006). Formal feminist movement in South Africa started with the 1990 Malibongwe conference in Holland, which birthed the 'Statement on the Emancipation of Women in South Africa'. This was followed by adoption of 'Women's Charter for Effective Equality' by Women's National Coalition in 1994 (African National Congress, n.d.). Local feminist efforts have since brought constitutional changes in the areas of gender equality and socio-economic rights (Hassim, 2005).

Apartheid South Africa, institutionalised gender based discrimination at the workplace. Denial of employment by legislation existed and promotion to management level was non-existent were employment occurred. The severity of such circumstances was felt more by racial definition (Bezuidenhout et. al., 2008). African

(black) women especially were corralled in forced settlements and forbidden from accessing education, and formal work or business (Meer, 1985; South African History online, n.d.a). The infamous Bantu education policy was a major tool for incapacitating the African (black) workforce (South African History online, n.d.b; Christie and Collins, 1982). However post-apartheid South Africa has seen the emergence of several legislations, strategies and interventions to empower women in the work place. There is the Act 66 of 1995 (labour relations act); Act 108 of 1996 (South African constitution Act); Act 75 of 1997 (Basic conditions of employment act and amendments 42/1996, 27/1998, 2/2002); and Act 97 of 1998 (skills development levies act). Complimentary legislations focus on health and safety, and workers' compensation for injuries and diseases (The South African Department of Labour, 2010). Despite such positive developments South Africa had poor global HRM rankings in the year 2000 (Grobler et. al., 2006). In response certain legislations have been amended, while new ones have been put into effect (Public Service Commission, 2006). Furthermore the government has instituted numerous programmes to address women employment, especially in the construction industry. However construction is still dominated by men, as shown by recent research (Didiza, 2008). In addition there are complimentary efforts by voluntary organisations towards levelling the playing field for women in construction. Despite such interventions, the figures remain low. Reasons proffered include discrimination in employments and promotions, and lack of support structures for female staff (Fielden et. al., 2001). Women made up 44.87% of the employed population in South Africa as at September 2009. However women in construction comprised only 13% (Statistics South Africa, 2009). Currently 31.20% of the women work force in South Africa is concentrated in the services industry. However construction, mining, utilities and transportation sectors, have low proportions of the women work force (Statistics South Africa, 2011). On the background of literature reviewed, and following from previous research, there is need for further investigations into the feminine footprint of the South African construction industry. For the purpose of the paper, update of the trend of employment is used as a backdrop for examining relationships between types of work, and race and education.

METHODOLOGY

To further update the existing work, more issues were interrogated, namely the trend of employment under types of work; and analysis of the current women employment situation, under types of work. Analysis was performed at a deeper level, considering formal and informal sectors of the South African construction industry. The South African Labour Force Surveys (LFS) data sets from Statistics South Africa, were utilised. Access was obtained through their online database, (www.statssa.gov.za/). Descriptive analysis is utilised at this stage of study. Evaluation of data consists of time series analysis, descriptive cross-sectional analysis, and regression. (Leedy and Ormond, 2010). By examining the trend, development of women employment in construction over time is ascertained and highlights are identified for cross-sectional analysis. The trend also shows indicators of the rate of response of the construction industry to issues and interventions highlighted in the literature review. From initial descriptive analysis, education and race are further investigated for relationship with employment status of women across formal and informal sectors of construction. The updated trend analysis was performed for the time frame of 2000 - 2011. Further detailed trend analysis showing women in various types of work within the

construction industry was performed for the time span of 2006 - 2011. The reduced scope in this case was due to limitations of data.

SUMMARY OF DATA ANALYSIS

There is general increment in the proportion of women employed, when compared with the men proportion. Hence there is long term trend of convergence, where the proportion of women increases steadily but minimally. The trend of convergence is more obvious in the formal sector of the industry. However the informal sector still demonstrates more volatility, as was the case in the previous research paper. The trend of women employment in the informal sector moves from convergence to divergence. In this case the proportion of women employed is declining in comparison to proportion of men. For types of work, analysis focused on senior official and management; professionals; technical and associate professionals; clerks; service works, shop and market sales people; skilled, craft and related trades; plant and machine operators and riggers; and elementary occupations. Of these work types, elementary occupations remain generally within the same range of 48% -60% women. Only women proportion of clerks and skilled / trade works show appreciable volatility over time. The most movements occurred between 2008 and 2010. The highest rise in proportion was recorded for clerks in 2009. Generally proportions of the higher level work types seem to be declining over time. In light of the above results, a cross-section of 2011 LFS data was evaluated. A majority (approximately 53%) of construction employees in elementary occupations are women. However only 14% of the women are employed in skilled crafts and trades. Other work types have less than 10% women proportion employed. Particularly, only 2% of the professionals are women. Senior and management positions have 7% women proportion, while technical and associate professionals have 5% women proportion. With regard to the relationship of women in types of work with education and race, education is the significant variable with a p-value of 0.009 and an appreciable coefficient of 1.28. When regressed separately, race seems to be significant with a p-value of 0.022, but a low coefficient of 0.47. Investigating educational level further shows that Africans (black) and Europeans (white) are at the extremes. The black women population group in construction have about 16000 people without formal education. White women make up 25.87% of tertiary educated women working in construction. More black women are found in primary and secondary education levels. Furthermore the distribution of educational levels seems to be between higher and lower level work types.

FINDINGS AND CONCLUSION

The paper represents excerpts from a wider research agenda. Limitations were due to the secondary nature of data. However results thus far enable deductions on which to progress in the research. With regard to the main thrust of inquiry, the significance of findings is in the following areas:

The trend analysis suggests that the gender-positive environment in post-apartheid South Africa has increased women employment in construction generally. While women employment has increased over time, the rate of increase suggests a very slow improvement. Secondly fluctuations occur more in the informal sector of the industry, while more women seem to be gaining employment in the formal sector. Thirdly while more women earn income from construction presently, the trend does not seem to yield much value for the women workforce, since most of the women are employed

in elementary occupations. Fourthly both race and education have strong relationships with types of work for women in construction. However education is the stronger predictor. Race being a predictor albeit reduced, confirms literature about South Africa's history. Other factors not analysed in the paper may be equally strong predictors. Furthermore, fewer women are employed in the managerial and professional work categories.

Findings at this stage raise the question of commitment on the part of the industry, in implementing government policies. Also there seems to be further reduction of racial barriers in employment, but a sub-optimal development in the educational status of the women. Similarly it is arguable that insignificant succession to higher levels of work is occurring for women in the formal sector, due to race and educational barriers. Traditionally race was the major dividing issue in South Africa. However it is directly linked to educational status and as such, access to higher level skills and more employment opportunities. Therefore the racial divide is still evident in the types of work for women in construction. Certain races dominate certain work types. Certain races seem to be better educated and skilled for higher level construction work types. It is also arguable that certain types of work in South African construction have become employment 'safe havens' or labour 'quarantine', for previously disadvantaged women in the country. The above deductions have been utilised in propositions for further research.

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A CONTINGENT VALUATION MODEL FOR ESTABLISHING THE VIABILITY OF PRIVATE SECTOR INVESTMENT IN URBAN WATER PROJECTS

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ABSTRACT

The millennium development goal (MDG) for sustainable access to safe drinking water and sanitation presents an enormous financing challenge, particularly to many low-income countries. This paper therefore aims at establishing effective user demand for water services through willingness to pay (WTP) in order to encourage private sector participation in water service provision using Lagos metropolis as case study. Data is collected by means of structured question are to establish the level of user willingness to pay and averting expenditure for water services. Analysis was carried out with both descriptions and inferential statistics. Findings show that users' WTP is reasonable, out varies from location to location. The study also established that the most significant factors affecting demand are high cost of alternative source, high cost of consequential damages and economic importance. This will provide a good guide to private sector investors in tariff setting and investment sustainability.

Keywords**:** private sector sustainability, viability, water infrastructure, willingness to pay.

INTRODUCTION

Sub Saharan Africa as a whole is unlikely to meet the millennium development goal (MDG) for water supply. Coverage in urban areas has been declining as utilities have struggled to keep pace with population growth. In the rural areas, more than 40 percent of the population continues to rely on surface water (Foster and Brienceno-Garmendia 2010). The situation is not different in urban areas where most households still rely on boreholes, wells, and vended water. Water is very critical to urban lives as its welfare implication cannot be overstated. Infections, diarrhea and other serious water borne illnesses are leading causes of infant mortality and malnutrition. Their impact goes beyond health to the economic realm in the form of lost workdays and school absenteeism. According to Barnegree and Morella (2011) it is estimated that meeting the Millennium Development Goal (MDG) for access to safe water would produce an

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economic benefit of US $3.1 billion (in 2000 dollars) in Africa, a gain realized by combination of time saving and health benefits.

In the face of these challenges, cities in less developed countries are growing at unprecedented rates. The various tiers of government are struggling to cope with the face of urbanization and there is ever increasing demand for water infrastructure services. It has become obvious that government alone cannot cope with the problem of infrastructure particularly water. There is therefore an urgent need to invite the private sector to participate in the provision of urban water services. Studies have shown that most urban dwellers purchase water at prices higher than that provided by public utility agencies. Government in developing countries including Nigeria have often subsidized water supply typically in an attempt to achieve social and health benefits for the low income households which constitutes majority of urban population (Montes De Oca, Bateman et.al, Tinch and Moffat 2004).In spite of this, the United Nations Development Program (1998) development report has called for subsidies to be phased out since all too often, they do not benefit those intended; the urban poor do not have any service at all, and do not receive the subsidy. The present end towards privatization is likely to end all such subsidies. In effect, if we want good water supply service, we have to pay for it. The private sector must establish affective demand before embarking on water project by eliciting user preferences and their willingness to pay for water provision. Willingness to pay for services will be much greater and the resource will then be used in ways that lead to increased satisfaction if infrastructure is built where there is sufficient demand for the services.

Over the years, government have been responsible for infrastructure provision by addressing the cost of building and maintaining water plants and network by collecting user fees, raising taxes, issuing bonds etc.

This is however characterized by shortages in capital funding and ever rising maintenance cost, lack of transparency and corruption. Tariffs are set to recover these expenditures but the revenue streams are insufficient coupled with resultant budget deficit due to underpricing and under collection.

The fundamental transactions whether concession or Public-Private Partnership (PPP) is that they provide a proven mechanism for government to alleviate the need for direct capital expenditure on new facilities while also potentially improving service provision. Generally the water sector reforms were composed of three components: decentralization, regulation and private sector participation. It is an integral part of the reform process. Many countries created national agencies for water, similar to the water services regulatory authority model of the United Kingdom.

Privatization of water infrastructure in sub-Saharan Africa is still emerging. Rather in response to growing appreciation of the problem of the traditional public enterprise model, many governments in Africa and elsewhere have attempted to improve the performance of state owned enterprises through performance contracts with public managers and or corporation.

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This study therefore aims at establishing effective demand for urban water infrastructure provision through user willingness to pay in order to encourage private sector participation in service provision using Lagos (Nigeria) Metropolis as case study.

Literature

Service delivery is the cornerstone of city governance and includes access to water, trash collection, wastewater etc. Financing of these services poses great challenges to different tiers of government in Nigeria. The reliability quality and cost efficiency in the provision of urban services are very central to the issue of governance. There is need for sustainability in infrastructure provision which requires; Cost recovery, Transparency, Stakeholder participation and Communication, Need assessment and willingness to pay and Accountability.

The governments have been unable to apply the above in urban governance and service provision. The way out of this situation is private sector participation in service provision.

Water infrastructure

In spite of the importance of water to man, it has remained scarce. Shortcomings in water supply in large urban areas of developing countries are a critical problem affecting millions of people, (WHO, 2002; Dublin, 1992 in Montes De Oca et al, 2004). Governments in developing countries have often subsidized water supplies typically in an attempt to achieve social and health benefits for the low income households, which constitute majority of urban population (Montes De Oca et al 2004). However, a perverse result can arise if the benefits of the subsidy go to high income households who achieve reliable services while poorer households have irregular and un-potable water supplies and may often purchase the water required from other unsubsidized informal or private sources.

The 2006 Human Development Report (HDR) stipulated a minimum of 20 liters of clean water a day for all as a human right, to check a growing water and sanitation crisis that causes the death of about two million children every year. According to the report, unclean water is greater threat to human security than violent conflict, across much of developing world.

It was revealed that each year, 1.8 million children die from diarrhea that could be prevented with access to clean water and toilets. In addition, 443 million school days are lost to water related illness, and almost 50% of all people in developing countries suffer at any given time from a health problem caused by a lack of water and poor sanitation. Unclean water and poor sanitation are directly implicated in the huge difference in life chance that separates children born in poor countries from children born in rich countries.

Most households, industries and real estate developers' in Lagos have to make provision for privately installed water infrastructure to meet their daily needs (Enendu, 2007; Lees and Anas, 1989). The poor may not be able to provide their own boreholes and therefore

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rely on supply from any affordable source. When it comes to clean water, the platform in many countries is that poor gets less, pay more, and bear the brunt of the human development cost associated with scarcity (UNDP,2006). In Lagos and most other parts of Nigeria, women and young girls carry a double burden of disadvantage since they are the ones who sacrifice their time and their education to collect water.

AVERTING EXPENDITURE

Mitigating expenditure and averting behavior

These approaches assess the value of non-marketed commodities such as cleaner air and water through the amount individuals are willing to pay for market goods and services to mitigate an environmental externality or to prevent a utility loss from environmental degradation or to change their behavior to acquire a greater environmental quality. It is the expenditure to avert or mitigate effect arising from reduction in quality of environmental assets (Garrod and Willis 2001, Callan and Thomas 1996, Otegbulu 2010). For example if water supply in an area is not regular, the consumer may resort to vended water supply as an alternative. Environmental values can sometimes be inferred from mitigatory expenditure or averting behavior.

Willingness to pay (WTP) for water infrastructure

A commonly applied approach for assessing WTP for improved water service is the contingent valuation method which involves a survey-based technique to directly elicit households' preferences (Montes De Oca and Bateman 2006, Otegbulu 2010, Mitchell and Carson 1989). The technique requires the construction of a contingent market through which correspondents may state their WTP for specified provision change in a particular good. When estimating WTP for water improvement within developing countries the scope test is complicated by the fact that income levels are correlated with current levels of supply ,such that those who would benefit most from a provision change to some specified level are those least able to pay for such changes.

Essential elements of the survey are description of environmental goods that are to be valued, description of the payment vehicle, and description of the hypothetical market. Describing the natural good include identifying all valuable attributes of the good. The payment vehicle pertains to how the money will be paid. One can pay for a good in cash any time it is used or by means of increased income tax. The description of the hypothetical market should include an identification of those who will provide and those who will pay for the improvement of the environmental good. It should be made clear that the payment is a collective action. Everybody else will also pay; otherwise, respondents may refuse to pay although they appreciate the good (Hoevengel, 1994; Mishra 1998, Desvousges et al, 1998; Freeman, 1993; Mitchell and Carson. 1989).

The valuation question can take several different forms. One is whether the question asks for respondents willingness to pay (WTP) for an environmental good, or their willingness to accept (WTAC) payment to forgo the good. Willingness to pay is the maximum sum of money a respondent would be willing to pay for an increase in an environmental amenity or to prevent degradation in one. Willingness to accept is the minimum sum of money respondents would require to forgo an improvement in an environmental amenity or to

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accept degradation in one. WTP takes as its reference point, the absence of the improvement while WTAC takes as its reference point the improvement. WTP is constrained by income while WTA is not (Freeman, 1993).

STUDY METHODOLOGY

Methodology

A CV survey questionnaire was designed to elicit information from households on their averting behavior, condition of service quality, willingness to pay for improved water supply preferred payment vehicle, and factors affecting demand.
Document on existing tariff structure was obtained from the Lagos Water Corporation.

The CV method usually values good which the respondents have experience in. The sample size is 1040 households spread over eight metropolitan local governments out of sixteen which constitutes the sample frame.

The local government for the study includes Kosofe, Eti-Osa, Alimosho, Ikeja, Mushin, Surulere, Apapa and Shomolu. Out of the 1040 questionnaires distributed 774 (77.4%) was returned and analyzed with the used of sample percentage, relative impact index and factor analysis.

WTP and averting expenditure will be compared with what households are currently paying for public utility water supply. Currently, block of flats pay₦500.00 per month, duplexes and detached houses pay₦800.00 per month while tenement rooms pay ₦1000.00 per room yearly. Public taps are paid by the local government authority.

RESULT

Respondent's characteristics

The respondents are mainly head or spouse of the household in their age is mostly above 20, while their average income is between ₦1,200,853 and ₦333,833.00 and most of the respondents have lived in the study area for more than 7 years which shows they have sufficient experience. Households in the study area prefer to pay for water through monthly bills or one off payment. Other sources of water supply include vended water, borehole, well water and rain water.

Table 1. Frequency of Pipe borne water supply

		Once a week	Twice per week	Thrice a week	Once a month	Twice a month	Total
Alimosho	Freq Count	9	24	26	4	5	68
	Percent	13.2	35.3	38.2	5.9	7.4	100%
Apapa	Freq Count	15	15	28	14		72
	Percent	20.8	20.8	38.9	19.4		100%

Eti-Osa	Freq Count	10	15	40	7	9	81
	Percent	12.3	18.5	49.4	8.6	11.1	100%
Ikeja	Freq Count	7	9	51	1		68
	Percent	10.3	13.2	75.0	1.5		100%
Kosofe	Freq Count	5	18	30	2	6	6
Percent	8.2	29.5			49.2	3.3	9.8	100%
Mainland	Freq Count	10	20	40	10		80
	Percent	12.5	25.5	50.0	12.5		100.0%
Mushin	Freq Count	12	23	30	7		72
	Percent	16.73	1.9	41.7	9.7		100%
Surulere	Freq Count	6	8	26	9		49
	Percent	12.2	28.6	81.6	18.4		100%

The responses from table 1. Shows that water supply is not very regular in most local government areas as majority of them have water supply only thrice a week. Others enjoy water supply once a week, twice a week, once a month or twice a month. In Alimosho local government 38.2% households have water supplied thrice a week while 35.3% have it twice a week. In Eti-Osa 49.4% of households have water supplied thrice a week while 75% of households also have water supplied thrice a week and 81.6% of households in Surulere local government, while 40% of households in Mainland local government enjoy water supply thrice a week.The frequency of supply cannot be said to be adequate. The water supply situation could influence consumer's priorities.

Table 2 .Mean monthly expenditure incurred alternative water supply

	Mean	Rank
Shomolu	₦ 2514	1
Kosofe	₦ 2031	2
Apapa	₦ 1800	3
Alimosho	₦ 1770	4
Ikeja	₦ 1604	5
Mushin	₦ 1446	6
Surulere	₦ 1438	7
Etiosa	₦1338	8

Table 3. Mean willingness to pay (WTP) for improved water supply

	Mean WTP (₦)	Rank
Apapa	2436	1
Shomolu	2394	2
Ikeja	2060	3
Eti Osa	2213	4
Surulere	18385	5
Kosofe	17936	6
Mushin	1688	7
Alimisho	1670	8

Source Field Survey 2009.

Table 2 shows the amount spent by households on alternative water supply on monthly basis. The highest expenditure is in Shomolu local government with a mean expenditure of (₦2,514.3) while Eti-Osa has the least mean expenditure of ₦1,338.8. This could form a basis for setting water tariff in the study area, when combined with WTP. The amount spent to abate the inconvenience of inadequate infrastructure provision can influence consumer preferences and what they will be willing to pay if there is improvement in water infrastructure provision. Eti -Osa has the lowest averting expenditure probably because they rely more on bore-holes and spend less on water vendors. The averting expenditure and willingness to pay could be used for tariff setting.

Data from Table 3 shows the amount of money households are willing to pay for improved water supply in the area. Apapa local government area has the highest mean WTP of ₦2436.6 while Alimosho had the least mean WTP of ₦1670.8. However it is noted that the results of WTP do not significantly relate to income in the study area. This could be attributed to the fact that

housholds feel reluctant to divulge their income for fear that the information could be used against them.

Table 4. Total variance experienced

	Initial Eigen values			Extraction Sums of Squared Loadings			Rotations Sums of Squared Loadings		
Component	**Total**	**% of variance**	**Cumulative%**	**Total**	**% of variance**	**Cumulative%**	**Total**	**% of variance**	**Cumulative%**
1	2.689	33.607	33.607	2.689	33.607	33.607	2.178	27.219	27.219
2	1.208	15.096	48.703	1.208	15.096	48.703	1.430	17.878	45. 098
3	1.026	12.828	61.532	1.026	12.828	61.532	1.315	16.434	61.532
4	.838	10.471	72.003						
5	.703	8.793	80.796						
6	. 600	7.499	88.294						
7	.471	5.887	94.181						
8	.465	5.819	100.000						

Extraction method principal analysis

Source field survey 2008.

Where; Component 1=Household need, Component 2= Poor condition of existing one, Component 3= Due to its economic importance, Component 4= High cost of alternatives,

Component 5= Importance to business, Component 6= High cost of consequential damage, Component 7= Alternative not reliable and Component 8= Alternative not affordable.

In the table 4 above only the first three components have values of above 1(2.689, 1.206, and 1.206). These constitute the most significant factors. Factors 1,2,3 captured all the variance in the components.

Table 5. Parameter estimation of the multiple regression analysis of influence of demand.

Parameters	**B-Coefficients**	**Standard error**	**Better t-value**	**Sigf.**
B0	-36.607	24.491	-	- 4.87	0.001
b1	0.885	0.212	.773	4.99	0.001
b2	0.796	0.219	.701	4.01	0.001
b3	0.772	0.324	.693	3.92	0.002

R^2=0.721 F-value 6.875

Table 5 shows the regression analysis output and is used to develop a model. Regression analysis performed on variables in respect of user demand preferences to determine the extent of the influence of the tree most significant factors with eign value above 1 was used to develop the model is as represented below;

$Y= -36.607 + 0.885X_1 + 0.796X_2 + 0.772X_3 + 24.491$

Where Y = User demand preference; X_1 = High cost of alternative source; X_2 =High cost of consequential damage; X_3= Due to its economic importance.

The largest factor that influence willingness to pay/demand preferences is high cost of alternative source with R^2 of 0.88 followed by cost of consequential damage with R^2 of 0.79 and lastly, economic importance with R^2 of 0.77. The performance of the overall equation is good as indicated by R^2 (0.721) statistics which explains 72% of the total variation about user demand preferences and willingness to pay for water infrastructure and F - Value of (6.875).

Discussion and conclusion

From the studies, provision of water from the public mains is epileptic forcing residents to resort to self-help like use of well water, boreholes and vended water supply at a cost higher than that charged by public utilities. This could be inferred from the averting expenditure and willingness to pay for improved water supply. Both the averting expenditure and willingness to pay per month are higher than the monthly tariff. Most households expend money on both public water supply and water from informal sector. This is a right signal that at 100% increase in tariff for improved and regular water supply is affordable to residents of the study area. The result of the factors analysis indicates the most significant factors that influence demand for water in the study area.

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THE ABILITY OF QUANTITY SURVEYORS IN LAGOS STATE, NIGERIA TO APPLY INFORMATION TECHNOLOGY

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ABSTRACT

The role of information technology in every sector of an economy of a nation cannot be emphasized. It had played a major role in meet the need of every client at a faster and efficient manner. The purpose of this study is to see the extent of use of information technology by quantity surveyors in project delivery in Nigeria. A total of 100 questionnaires were distributed and 65 were returned and used for the analysis, given a response rate of 65% .The population consists of registered quantity surveyors from 2007 till date. It was obtained from the professional body institute (Nigerian Institute of Quantity Surveying-NIQS).The respondents were randomly selected from the sampling frame. Descriptive research was used for this study. The data was analysed using SPSS 17th edition via percentage, mean item score and ranking. The study shows that most quantity surveyors acquired the knowledge of IT by self taught and in most quantity surveying firms, IT is used for costing, hence it make it easy to retrieved all past document and in taking decision. In essence IT serves as cost library for quantity surveying firms. IT aid practicing quantity surveying firms in preparing approximate estimating and aid as a cost library

Keywords: Delivery, Information Technology (IT), Performance, Quantity Surveying, Services.

INTRODUCTION

According to Ang et al(1997) cited in Gaith et al(2009), Information technology(IT) is the technologies dedicated to information storage, processing and communication. This is made up of software, hardware and telecommunication which convert the raw data into information for speedy retrieval. IT plays a vital role in sustaining the growth of any business organisation especially construction industry which contribution to the nation economy cannot be quantified.

IT has helped in fast, efficient development and management of building deliveries in the built environment especially quantity surveying profession. It had made it

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possible to organize complex construction process in quantity surveying and in construction industry as a whole in a logical manner that enhances project performance. According to Shar (2012),in their study on the application of 'specification manager' in Pakistan, it was realized that numerous software packages are used in UK construction industry in various field such as Architectural design, Civil Engineering, Quantity Surveying, programme of work, specification, valuation, marketing, financial and site management. IT therefore has positive impact in construction services in the various field of the industry and in capital investment.

In Australian, Sohal et al (1998) studied Australian companies and found that IT is positively correlated to organisation performance. According to the study of Valida et al (1994) in Malaysia, IT use and integration are higher in companies providing goods and services than those in manufacturing and distribution. While Mul et al (2002) cited in Gaith et al (2009) study, also in Malaysia realized the used of Internet as an important tool to the Malaysia companies. The use of internet had not been fully harnessed by the Malaysian companies. It was concluded that they should improve their infrastructure and employed computer staff. Pamulu and Bhuta (2004) opined in their study on Indonesian construction industry that IT had helped in achieving cost saving and adequate communication among stakeholders in the industry.

Most developing countries have been slow to adopt the use of IT in their construction industry due to the advantage of IT on the betterment of project performance .It therefore becomes necessary for developing countries especially Nigeria to take advantage of the IT by exploiting the various technology resources available to improve the processes of their building industry since the future growth will depend largely on improvement of human resources. This study is based on the ability of quantity surveyors in applying IT for project delivery.

LITERATURE REVIEW

IT can no longer be view as an enhancement to traditional business procedures but as an innovation agent that enables new and different alternatives in operation of business organisation. The use of IT in construction is extending beyond the boundary of piecemeal application for improving the efficiency of discrete operation of individual organizations. It could also be used in government agencies and professional institution.

Quantity surveyors are one of the stakeholder involved at the inception and construction stage of construction industry Their paramount function to the client cannot be over emphasize and also to other professional bodies in the industry. They are referred to as the cost accountant in the industry and so they are both management and technology oriented. Quantity surveyors have broad knowledge in design, engineering, economics, law and management (Alabi, 2009).Hence IT could be used by them in order to broaden their scope and deepen the extent of his services to clients, other stakeholders and the construction industry at large (EL-Rufai, 1992).

The common types of software used in construction include are word processing, spreadsheet, CAD and internet software (Oladapo, 2006).CAD is mostly used for design, drawing and presentation (Rivard,2000).Quantity surveyors use IT for preparing bills of quantities(BOQ), estimating, measurement and presentation.

There are others IT packages that are used by quantity surveyors. They include WinQS32, QS Plus2001,QsCAD,CATO and Masterbill (Wills et al,1994;Adetola,1998;Murray et al.,2001)It software enhance service delivery of quantity surveying firms by ensuring accuracy in estimating and final account.

Although quantity surveyors in Nigeria have embraced the used of IT but there are some lapses. Such lapses is due to lack of clear understanding of cost and economy and also lack of proper training of professional staff (Alabi,2009).Also unwillingness of the senior management to delegate responsibility to junior staff through training on the usage of the IT software.

A number of research survey related to IT in developing countries are limited (Pamulu and Bhuta, 2004).It is due to scarcity of IT professionals, inadequate physical and information infrastructure, social and cultural diversity and political barriers that modulate and distort competitive markets.

Weighing the advantages of IT, it becomes necessary that quantity surveying firms and the construction professional should avail themselves of the various tool provided by IT in order to improve the performance of their service delivery from inception to final completion.

RESEARCH METHODS

The research was conducted by an examination of relevant literature followed by administration of questionnaires to quantity surveying contracting organisation and consulting firms. The list of the quantity surveyors are obtained from the professional body of the institute (Nigerian Institute of Quantity Surveying) ,who are registered members from 2007-till date. The quantity surveyors were randomly selected from the obtained list. The questionnaire sought to know respondents' personal data and to obtain some other data such as mode of acquisition of computer literacy, level of use of computer packages, its constraints on the uses and the impact of computer on quantity surveying service delivery. The questionnaire used a five point likert scale to measure a range of opinion from "strongly disagree" to "strongly agree", "not used" to "most use". 100 copies of the prepared questionnaires were distributed, 65 completed copies were returned and used for the analysis. The average response rate to the questionnaires was 65%.This response rate is considered adequate as according to Ellhag and Boussabaine (1999), Idrus and Newman (2002) cited in Oladapo (2007). A descriptive research design is used for this study. The data were analysis using Social Statistic for Social Sciences (SPSS) package 17th edition. The statistic tools used are descriptive statistic via percentage, ranking and mean item score (MIS) was used to analyse the data using this formula

$$MIS = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + n_1}{5(n_5 + n_4 + n_3 + n_2 + n_1)}$$

Where:

N_5=no of respondents with strongly agree; N_4= no of respondents with agree

N_3= no of respondents with neutral; N_2= no of respondents with disagree

N_1= no of respondents with strongly disagree

That is: 5-strongly agree, 4-agree, 3-neutral impact, 2-disagree, 1-strongly disagree

DATA ANALYSIS AND RESULTS

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Background information

Table 1 shows that 54% of the respondents have been in quantity surveying firm for less than 5years while 31% of the respondents are in the firm for less than 10years and only 15% have been there for above 10years.They have educational qualification ranging from national diploma(15%),higher national diploma(29%),Bachelor of science(45%) to Master/doctorate(11%).It implies that the respondents are knowledgeable to fill the questionnaire and they have adequate background of quantity surveying firm.

In term of years of experience, most of the respondents have over 10years(39%) experience,12% of the respondents have over 20years in quantity surveying firms.48% of the respondents are corporate member of the institution and 16% are fellow member of the institution. It implies that the respondents have adequate professional background of the profession.45% of the respondents are computer literate for over 10years and just 8% are computer literate above 10years.38% acknowledge that they have been using computer for quantity surveying services in their firm for over 10years and 29% for less than 10years.

Table 1: Background information

Background information	Frequency	Percentage (%)
Respondents years in the firm		
1-5years	35	54
6-10years	20	31
Above 10years	10	15
Total	65	100
Educational qualification		
ND	10	15
HND	19	29
Bask	29	45
M.Sc./PhD	7	11
Total	65	100
Years of experience in quantity surveying firm		
Less than 5years	5	8
6-10years	25	39
11-15years	17	26
16-20years	10	15
Above 20years	8	12
Total	65	100
Professional qualification		
Graduate/probationer member	21	33
MNIQS	30	48
ANIQS	10	16

Others	2	3
Total	63	100

Table 1(Contd.):Background information

Background information	Frequency	Percentage (%)
1-5years	19	30
6-10years	28	45
Above 10years	5	8
None	2	3
Total	63	100
Years of use of computer for quantity surveying services in the firms		
Less than 1years	9	14
1-5years	12	19
6-10years	19	29
Above 10years	25	38
Total	65	100

Mode of acquisition of computer literacy

Table 2 presents the mode of acquisition of computer literacy by the respondents. Self taught using computer manuals is the most used method for acquiring computer knowledge by the respondents. Other modes of acquiring computer knowledge are in-service training given by employer, learnt at school and the least used is private instructor.

Table 2: Mode of acquisition of computer literacy

Acquisition of computer literacy	Mean	Rank
Self taught using computer manuals	4.89	1
In-service training given by employer	4.00	2
Learnt at school	3.65	3
Training by professional bodies(conferences, seminar)	3.45	4
Private instructor	2.67	5

1=not used, 2=least used, 3=little used, 4=used, 5=most used

Level of use of computer packages

40% of the respondents use computer packages for costing. It is due to the fact that the core business of quantity surveying firms is costing.22% used computer package for internet communication and 15% for word processing and scheduling. The least used computer package is for accounting and design (3%) as shown in table 3.

Table 3: Level of use of computer packages

Computer packages	Frequency	Percentage (%)
Word processing	10	15
Internet communication	15	22
Costing	26	40
Scheduling	10	15
Accounting	2	3
Design	2	3
Total	65	100

Application of computer on quantity surveying practicing firms

Respondents strongly agree that ease of retrieval of past project information has a high impact on the usage of computer on quantity surveying practicing firms. Other impacts of computer on quantity surveying service delivery are meeting deadlines, improve performance of work and interaction with clients and also facilitate decision making as presented in table 4. The respondents disagree that it could reduce reimbursable charges and increase the cost of maintaining computer.

Table 4: Impact of computers on quantity surveying service delivery

Variables	MIS	Rank
Enhance ease of retrieval of past project information	0.99	1
Enhances meeting deadlines	0.98	2
Improve performance of work and interaction with clients	0.96	3
Facilitate decision making	0.90	4
Increase staff productivity	0.90	4
Enhances ease of productions of project/contract document	0.80	6
Ease communication through internet	0.78	7
Ease coordination and integration of project information among stakeholders	0.75	8
Gives users competitive advantage	0.75	9
Reduces paperwork	0.66	10
Reduces reimbursable charges	0.46	11
Increase cost of maintaining computer	0.45	12

1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree

Constraints on the use of IT

From table 5 below, inadequate power supply is rank first by the respondents as a very strong constraint to the use of IT by quantity surveying firms. It is due to erratic power failure in Nigeria, whereby firms have to depend on their own source of supply of light. The cost of purchasing quantity surveying software for preparing

bills of quantities and lack of knowledge of the usage of the software are also constraints on the use of IT as identified by the respondents.

Table 5: Constraints to the use of IT by quantity surveyors

Constraints	**MIS**	**Rank**
Inadequate power supply	0.98	1
Cost of purchasing quantity surveying software for preparing bills of quantities(master bill)	0.95	2
Lack of knowledge/usage of quantity surveyors software	0.79	3
High cost of employing quantity surveyor instructor	0.70	4
Updating of quantity surveyors software	0.66	5
Virus attack	0.50	6
Personnel abuse of system	0.46	7

1=very weak, 2=weak, 3=moderately strong 4=strong, 5=very strong

CONCLUSION

This study shows that the application of IT on quantity surveying practicing firms cannot be quantified. IT ensures ease of retrieval of past information; hence serve as cost library for quantity firms. It also enhances the firms meeting deadlines and a better interaction with clients. IT had been used by this firm's mostly costing, internet communication and word processing. Although there have been some shortcoming in using the quantity surveying software, It is due to cost involved in acquiring the software, on adequate knowledge on the use of quantity surveying software and very few instructor to teach the professional on the usage of the software. The quantity surveyors function which are suppose to be computerized entail estimating, programme of work, taking off and billing are not sufficiently made available in the firms. Most of the quantity surveyors acquired computer knowledge through self training as shown from this study. It shows the lapses of computer educators in the field of quantity surveying in the various tertiary institutions. And where the educators are available, there are no sufficient computer packages and computer system to be used by students. It is also affected by erratic power failure in our campus which limit the constraints of the use of IT where intending quantity surveyors are suppose to acquired the skill on the use of IT.

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CONSTRUCTION CONTRACTORS'SURVIVAL STRATEGIES IN A DEPRESSED ECONOMY IN LAGOS STATE, NIGERIA

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ABSTRACT

The recent worldwide economy downturn has meant changes in Nigeria's dynamic business environment with less construction work available and competition among contractors. Contractors and Builders main focus during a recession should be affirmative and proactive. This study therefore assesses the survival strategies for construction contractors in order to remain viable in a depressed economy. To achieve these objectives, a field survey was conducted on a sample of 75 contracting firms by stratified random sampling. The survey was conducted with the aid of structured questionnaires and analysed with the aid of scientist package for social sciences. The result indicated that rising cost of construction materials and inadequate training of supervisory/technical is the major causes of failure in a depressed economy, and also difficulty in getting bank loan/difficulty in securing projects are the main effect of depressed economy on construction contractors. In conclusion the most effective strategies for survival for construction contractors are to build a sustainable construction using different materials and improving the required improvement in quality of work.

Keywords: Contractors Depressed Economy, Nigeria, Strategies, Survival.

INTRODUCTION

With the current global recession, the economy of most developing countries has been thrown into very serious problems. Adner and Sherif (2009) affirm that the construction industry has unique characteristics that sharply distinguish it from other sectors of the economy. It is fragmented, very sensitive to the economic cycles and political environment, and has significant high rate of business failure. Contractors who have built up their firms through years of hard work are facing the most severe depression in decades (Ganaway, 2009). The global depression has created a structural break in the global economy. Businesses thus need to reassess their strategies for operating a highly integrated global economy. According to Oyesola (2010), this is an understatement to say that the workers are operating in a depressed economy because the monthly pay cannot meet the needs of the workers. The overall effect of the depressed economy had worsened the conditions of the construction

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contractors in the country. So many construction companies both indigenous and expatriate had been forced to close down or relocated while those in operative are cutting corners and subjecting workers to inhuman exploitative and oppressive conditions of working in the guise for quest to break even. It had lead to unemployment, inability to fulfil social obligation and retrenchment in order to down size thereby embarking on contract staff or outsourcing. It is all anti-labour practices that lower the esteem of workers. The pressure of Structural Adjustment Programmed (SAP) and globalization weakened the economy by increasing the number of people with low incomes, unemployment and poverty. Construction contractors therefore adopt various strategies in order to achieve the objectives of their firms and for continuity (Olaniyi, 2009). The study of Lim et al, (2010) on contractor strategies in Singapore in a prolonged recession shows that contractors bid for more projects within their resources and capabilities. Project management, material wastage, financial management on firm's cash flow, froze salaries of workers and retained profit for unforeseen circumstances are the various techniques used by construction contractors to survive in a depressed economy. However, times of crisis are also times of opportunity, such as businesses developing foresight to use the economic downturn to position for the next upswing.

2.0 Strategies for survival of Construction Contractors

Strategic planning is an essential function of top management in a construction company. This strategy is devised with a problem-solving approach of system analysis in the following stages: examination of the company's mission, a survey of the company's business environment, an analysis of the company resources, development of a strategy and the choice of optimal strategy (Warszawski, 1996). Strategies in the development of the construction capacity involve development, adoption and modification of construction policies to be employed on construction sites, the implementation of incentive schemes, the implementation of quality control procedures, and advancement of labour training programs.

Marketing of construction services requires a number of strategies according to the attributes of the type and nature of the service provided at any one point in time (El-Higzi, 2001). The construction industry as a service industry survives on goodwill and image laundering. An overview of the literature, which allies strategic marketing to successful performance, reveals two areas of concern: the definition of the company mission and the nature of strategic plans and objectives (McKee et al, 1989; Jaworski, et al, 2000).According to Ansoff (1989), the primary objective of survival for the construction firm is to secure a sustainable advantage in the market against its competition. The firm must be able to work out its survival techniques through strategy in the context of the overall competitive scene. To determine what drives the market and where to compete, it must be able to respond to environmental forces that influence the choice of the appropriate strategies.

The total volume of construction demands fluctuate as the nation develops and the survival techniques for the firm is to diversify to markets where the opportunities exist for responding to the dynamic environment. This is of critical importance, especially given the fluctuating nature of the construction markets (Teo and Runeson, 2001). Taking account of changes in the markets, construction firms need to learn appropriate survival techniques to gear themselves up for opening in new markets.

3.0 Research methods

A survey research design approach is adopted with the population comprising of project manager, Engineers, Builders, Quantity surveyor and Architects, all drawn from construction firms located in Lagos State. Judgmental sampling technique was used for this study and data were collected at one point in time through close ended self-administered questionnaire. A total of 75 questionnaires were administered to construction firms and 50 were returned. The average response rate to the questionnaires was 67%, this response rate is considered adequate according to Oladapo (2007). SPSS 17th edition was used to analyse the data collected via percentage, ranking and mean.

4.0 Results and analysis of data

Demographic information

Table 1 presents the demographic information of the respondents for this study, 26% of the respondents are Builders and Quantity Surveyors, 20% are Structural Engineers and 14% are Architect.24 (28%) of the respondents obtained Bachelor of Science degree (B.Sc.) as educational qualification and 26% are Master holders (M.Sc.) in their respective fields.20% is HND (Higher national diploma) holders and 2% are OND (Ordinary national diploma) holders. These shows that the respondents have adequate educational and professional knowledge of their profession and so are knowledgeable to fill the questionnaires. In respect of professional level, 27% are both member of Nigerian Institute of Builders (NIOB) and Nigerian Institute of Quantity Surveying (NIQS), 22% are member of Nigerian Society of Engineers (NSE) and 14% are members of Nigerian Institute of Architecture (NIA).

Table 1: Demographic information of respondents

Demographic information	Frequency	Percentage (%)
Profession of respondents		
Builder	13	26
Architect	7	14
Structural Engineer	10	20
Quantity Surveyors	13	26
Others	7	14
Total	50	100
Educational qualification		
OND	2	4
HND	10	20
B.Sc.	24	48
M.Sc.	13	26
Other	1	2
Total	50	100
Professional qualification		
NIA	7	14
NSE	11	22
NIOB	13	27
NIQS	13	27
Others	5	10
Total	49	100

Survival strategies of construction contractors

The professionals were of the opinion that for a contracting firm to survive under a depressed economy, quality of the material is a fairly significant factor with a mean (3.12). It is followed by educating the craftsmen with a mean (2.98). Cut in profit to keep workforce and equipment working ranked third with mean (2.81) followed by Development of resourcing for finance and re-use of resources. Shedding expenses as necessary ranked 6th with mean (2.70).The least effective strategies for construction contractor's survival are reduced vacation time until things improve which ranked 18th with mean (1.85) and discounting ranked 19th with mean (1.83) as shown in table 2.

Table 2: Survival strategies of contractors in a depressed economy

Survival strategies variables	N	NE	NS	FS	S	HS	Mean	Rank
Improving quality of materials	50	1	2	7	20	20	3.12	1
Education of craftmen	50	2	6	4	17	21	2.98	2
Cut in profit to keep workforce and equipment working	50	2	4	10	16	15	2.81	3
Development of resourcing for financial	50	1	1	16	20	11	2.80	4
Re- use of resources	50	3	2	11	21	12	2.76	5
Shedding expenses as necessary	50	3	4	10	21	12	2.70	6
Multi-tasking operatives of workers	50	2	5	14	13	15	2.69	7
Cheaper imported building materials	50	1	3	19	15	12	2.68	8
Cutting out waste	50	4	8	8	18	11	2.49	9
Restructuring plan	50	4	7	12	15	11	2.45	10
Redistribution of responsibilities	50	4	8	8	21	8	2.43	11
Development of new business field	50	8	5	10	16	10	2.31	12
Tendency for international mergers and acquisition	50	2	7	23	11	6	2.24	13
Reduce investment	50	3	13	10	16	5	2.15	14
Venture outside its traditional area of construction	50	5	11	13	12	7	2.10	15
Word of mouth marketing	50	7	6	25	8	4	1.92	16
Staff layoffs	50	6	16	12	9	6	1.86	17
Reduce vacation time until things improve	50	8	9	16	12	3	1.85	18
Discounting	50	13	5	14	9	7	1.83	19

1- (NE) 2- Not Significant (NS) 3- Fairly Significant (FS) 4- Significant (S) 5- Highly Significant(HS)

Effect of depressed economy on construction contractors

The ranked factors from one to six represent the most significant of all nineteen factors while the factors from seven to fourteen are significant for consideration. Difficulty in getting bank loan ranked first with Mean (4.24) followed by difficulty in securing project with mean (4.22) as presented in table 3. Delay in time of delivery of service ranked third with mean (4.08) and lack of capital ranked 4th with mean (4.06). Inadequacy in meeting client demand with mean (3.50) and diaporisation (Relocating outside the country) with mean score (3.10) are the least effect of depressed economy on construction contractors which ranked 18th and 19th respectively.

Table 3: Effects of a depressed economy on construction contractors

Survival strategies variables	N	SD	D	UD	A	SA	Mean	Rank
Difficulty in getting bank loan	50	0	1	6	23	20	4.24	1
Difficulty in securing project	50	0	3	3	23	20	4.22	2
Delay in time of delivery of service	50	0	3	6	24	16	4.08	3
Lack of capital	50	1	3	4	26	16	4.06	4
Insufficient cash flow	50	0	3	11	18	17	4.00	5
Noncompliance to building code	50	2	5	9	11	22	3.94	6
Poor workmanship	50	1	2	8	28	11	3.92	7
Difficulty in maintaining production quality	50	0	4	9	25	11	3.88	8
Unavailability of bank loan	50	1	4	10	21	14	3.86	9
Problem of employing qualified personnel	50	2	1	9	30	8	3.82	10
Unavailability of finance and financial strategy	50	1	4	10	24	11	3.80	11
Poor labour	50	0	4	9	33	4	3.74	12
Cost overrun	50	2	3	11	24	10	3.74	12
Maintaining profit	50	2	5	11	19	13	3.72	14
Advancement in construction technology	50	2	5	7	27	8	3.69	15
Sustainability in operation	50	1	3	17	19	9	3.65	16
Bankruptcy	50	4	4	13	14	14	3.61	17
Unable to meet client demand	50	3	8	7	22	8	3.50	18
Diaporisation (Relocating outside the country)	50	5	9	17	14	5	3.10	19

1-strongly disagree, 2disagree, 3-undecided, 4-agree, 5-strongly agree

5.0 Conclusion

This study shows that for construction contractors to survive in a depressed economy sustainability of construction using different materials is an important strategy to be used by the contractors in order to continue in business. It applies to both indigenous and expatriate contractors. The key to strategy under stress is discipline. Therefore the survival strategy should focus on segment that is resilient during the downturn. Other strategies as identified in this study are educating lower skilled workers, Cut in profit to keep workforce and equipment working, development of new financial solution, re-use of resources and shedding expenses as necessary. If the above stated actions are taken into consideration then the construction contractors business will be better and run smoothly. The depressed economy will have little or no effect on their survival. Effect of a depressed economy on construction contractors are difficulty in obtaining loans, delay, insufficient cash flow and lack of capital, but with the strategies being implemented the effect will not have a negative outcome on the performance of the contractors in such an economy.

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TRANSACTIONAL COSTS ARCHITECTURE OF LIGHTING RETROFITS FOR SOUTH AFRICA'S RESIDENTIAL BUILDINGS

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ABSTRACT

South Africa faces apparent electricity energy poverty and has heavily invested in the promotion of energy efficiency measures in buildings. However, performance parameters in energy efficiency programmes for buildings in South Africa remain lacklustre and are indicative of an inability to achieve intended market transformation or resource acquisition. Worldwide studies agree that the electricity energy efficiency markets often experience prohibitory adoption costs commonly associated with market failures or crippling barriers. Oliver Williamson's 'transactional costs theory' supports state intervention as a way of correcting the perceived market failures or barriers. As a way of understanding the cost dynamics in electricity energy efficiency adoption, this study focused on unravelling transactional costs architecture for lighting retrofits in South Africa's residential buildings. Using a combination of interviews with industry players and documentary analysis the prevailing transactional costs architecture for lighting retrofits in South Africa's residential buildings was modelled. Suggestions were then made on appropriate intervention foci needed to reduce the adoption costs for lighting retrofits in South Africa's residential buildings.

Keywords: Energy efficiency, lighting retrofits, South Africa, transactional costs.

INTRODUCTION

Two main issues prominently plague South Africa's electricity supply industry. These are the impending electricity supply deficit (Eskom, 2008), and highly carbon intensive electricity (Department of Minerals and Energy, 2005). These twin issues are some of the drivers for energy efficiency in South Africa. This may explain massive investment in electricity energy efficiency by the National Energy Regulation of South Africa (NERSA) which committed R 5.44 billion for the years 2011-2013 on energy efficiency for programmes run by Eskom (Eskom, 2011). Also noted is the R544 million invested by Eskom in energy efficiency programmes against an annualized saving of 1 339GWh for the 2011 financial year (*ibid*). This translated to an average unit cost of 0.0004 R/kWh of *negawatts* without considering the time

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value of investment. It is also noted that residential lighting initiatives accounted for over 56% of electricity savings; (*ibid*). So far, over 47 million free CFLs being distributed since inception in the 1990s thus making it world's largest.

At between 40-30% of primary energy consumption, buildings account for substantial portion of energy use (UNEP, 2007). In South Africa, residential buildings alone account for 17% of energy use (Department of Minerals and Energy *et. al.*, 2002). An earlier figure on total electricity demand in all metropolitan buildings was approximated at 27% (Anderson *et. al*, 1995). It is therefore no wonder that the reviewed energy efficiency strategy targets a 10% demand reduction in electricity use for residential buildings by 2015(Department of Minerals and Energy, 2008). This target is perfectly achievable if certain organisational and market issues are addressed. However two issues currently cast the performance of South Africa's energy efficiency programmes as marginal. First is the seemingly low annual primary resource acquisition of 354 MW from demand side management programme against an average unit cost of 0.0004 R/kWh of *negawatts* in the last financial year (Eskom, 2011). Second is the inconsistency in overall electricity primary resource acquisitions depicted by annual comparison of Eskom's demand side management programmes for the last 5 years (see Figure 1).

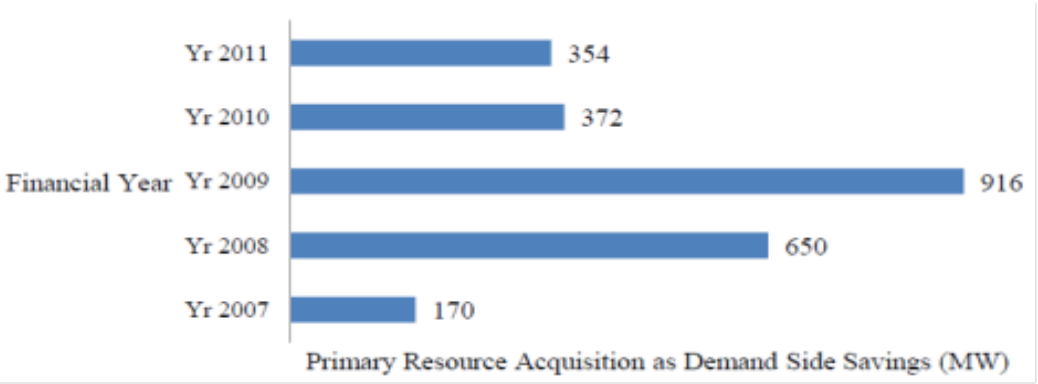

Figure 1: Primary electricity savings from demand side management energy efficiency programmes by Eskom; Eskom, 2011

The marginal performance could be related to certain market related issues best explained by transaction cost theory. To restate the transactional cost theory, it is posited that energy efficiency market transaction costs are prohibitive and warrants interventions to ensure minimisation (Golove and Eto, 1996). This paper attempts to outline the transactional cost architecture for lighting retrofits in South Africa's buildings. Borrowing from Mundaca *et al.* (2005), the following question is discussed:

> *What is the nature and scale of transactional costs of energy efficient lighting retrofits in South Africa?*

The importance of the paper is derived from the fact that greater understanding of transactional cost structure may ensure innovative intervention measures in the energy efficiency markets.

METHODOLOGY

Methodologies for the estimation of actual transactional costs for energy efficiency retrofitting or innovation adoptions remain enigmatic (Wang, 2003; McCann *et al*.,

2005). Mundaca and Neij (2006) outline three main methodologies for estimation of transactional costs, viz: 1) the use of seasoned informants' accounts such as those involved in programme design, decision making processes and lead adopters, 2) use of institutional data from agencies undertaking programmes and 3) use of labour and other time dependent costs emanating from field study. This paper uses a combination of in-depth interviews with key stakeholders and literature survey to explore the nature of transactional costs in South Africa's Eskom run lighting retrofits programme. The study utilised documents review and interview to gather information on lighting retrofits activities in programmes run by Eskom. Specifically respondents included members of the SAAE, Energy Service Companies (ESCOs) and residential end users. For the ESCOs programme key informants interview was conducted with two executive members of SAAE which oversees registration and pre-qualification issues and four other medium and senior employees of Eskom within demand side management programmes portfolio. For lighting retrofits, structured interviews were conducted with 43 home owners; two interviews with ESCOs and one interview was conducted with a CFLs distribution outlets' Executive. To complement interview sessions, documents on energy policy and demand side management were reviewed. The information gathered was then used to model transactional costs architecture for lighting retrofits in South Africa's residential buildings.

TRANSACTIONAL COSTS AND ENERGY EFFICIENCY PRACTICES

Two competing arguments exist with regards to energy efficiency market conceptualisation. On one hand is the postulation that perceives the energy efficiency market as fraught with barriers and in need of government intervention (Golove and Eto, 1996). On the other hand is the opinion that the energy efficiency market has a capacity to achieve the desired efficiencies and self-correction and as such government interference is unwelcomed in cases of temporal market failure (*ibid*). However, all schools of thoughts are unanimous that markets imperfections exists and hence the notion of market barrier or market failure. Bhattacharya (2011), Golove and Eto (1996) and Jaffe and Stavins (1994) all agree that the occurrence of market barriers or failures could be best explained using the concept of efficiency gap. Energy efficiency gap is the difference between the cost effective level of investment in energy efficiency based on engineering-economic analysis and the level of actual investment made (Bhattacharya, 2011; Golove and Eto, 1996 and Jaffe and Stavins, 1994). Sathaye and Murtishaw (2004) and Bhattacharyya (2011) further explains that the supply curve of conserved energy indicates the amount of energy that could be saved based on technical potential analysis on adoption of certain energy efficiency measures but this not often practical due to market barriers or failures.

Market intervention by the government is therefore sought so as to reduce efficiency gap. Market barriers include misplaced incentives, lack of access to financing, flaws in market structure, inappropriate pricing and regulation, gold plating and information related issues such as lack of information or misinformation (Golove and Eto, 1996; Sathaye and Bouille, 2001). As an example of manifestation of market barriers, it is noted that from the period of its introduction to date, CFLs have struggled to achieve marginal success in securing market share in the US (Sathaye and Murtishaw, 2004; Itron, 2004; Menanteau and Lefebvre, 2000). This is probably because of high initial cost, quality of illumination and an initial non availability in standard sizes (Sathaye

and Murtishaw, 2004; Itron, 2004; Menanteau and Lefebvre, 2000). The high initial cost is particularly related to the transaction costs as a result of setting up the roll-out network, administration, and performance of due financial and environmental diligence (Sathaye and Murtishaw, 2004). This forms the basis of discussion in this paper.

TRANSACTIONAL COST ARCHITECTURE FOR LIGHTING RETROFITS

An up to date understanding of transactional costs structure is of essence as it provides the basis of assessment and evaluation of market forecasts for energy efficiency improvements in addition to informing the formulation of measures targeted at elimination of transactional costs related market barriers (Mundaca and Neij, 2006). This is particularly emphasised by Painuly *et al.* (2003) who aver that the transactional costs constitute a significant part of market barriers to adoption of energy efficient practices and technologies. Thus where transactional costs are high, the energy savings may fail to achieve desired financial savings leading to longer payback periods which hamper adoption of energy efficient practices (Sanstad *et al*., 1994). Conceptually, transactional costs are those costs that arise during exchange of ownership rights of economic assets as a result of lack of information by the buyer (Hein and Blok, 1995). It is particularly noted that in energy efficiency demand side management programmes transactional costs manifests itself heavily during planning, implementation and monitoring and evaluation phases (Mundaca and Neij, 2006). However, for projects under the auspices of IPCC, other phases such as in issuance of tradable white certificates, trading in of the white certificate and redemption may ensue (*ibid*).

There is a consensus on the components of these costs. Hein and Blok (1995) identify these costs as those related to information, decision making, implementation and monitoring of retrofits. Valentová and Knápek (2011) specifically single these as those incurred by programme administration and subsidy recipient. The public administration based transactional costs are those related to design of the programme, technical expertise (engineering and legal based), programme administration, validation and processing of the programme, monitoring and verification and quantification of the results *(ibid*). The subsidy recipients incurs transactional costs relating to information search, initial negotiations, development of application, bank fees, negotiation of the contract, procurement, project validation and monitoring (*ibid*).

Hayashi *et al.* (2010) suggest a framework for that could be used to estimate CFL retrofits. Table 1 outline estimated model costs for 3 CFL retrofitting scenarios(1) the modest unit cost of CFL retrofitting for India, (2) High unit cost of CFL retrofitting for India and (3) Nominal unit cost of CFL retrofitting. Table 2 yields proportionate costs for the same scenarios.

Table 1: Estimated model costs for CFL retrofitting programmes, Hayashi *et al.* 2010

Table 2: % model costs for CFL retrofitting programmes, Hayashi *et al.* 2010

Cost Components		Modest Unit CFL Retrofitting Cost in India	High Unit CFL Retrofitting Cost in India (EUR)	Nominal Unit CFL Retrofitting Cost (EUR)
Fixed Cost	Programme Management-Upfront	0.38	0.38	0.38
	Programme Management-Annual	0.06	0.06	0.06
	Monitoring-Upfront	0.13	0.13	0.13
	Monitoring-Annual	0.01	0.01	0.01
	CDM fees-Upfront	0.09	0.09	0.09
	CDM fees-Annual	0.06	0.06	0.06
Variable costs	CFL Procurement	3.30	5.8	4.50
	CFL distribution &	3.80	5.0	0.51
	Other Costs	0.30	0.8	0.01
Total		8.13	12.33	5.75

It is instrumental to note that India's case appear most appropriate because of similarities in structure to the South Africa's lighting retrofit programme. In particular both programmes are based on rollout of the lighting fittings with minimal client's investment. As a result, the transactional costs categories are largely included in the

Cost Components	Modest Unit CFL Retrofitting Cost in India (%)	High Unit CFL Retrofitting Cost in India (%)	Nominal Unit CFL Retrofitting Cost (%)
Programme management costs	9%	5.9%	2%
CFL Procurement	40.6%	47.0%	78.3%
CFL distribution & retrofits	46.7%	40.6%	0.1%
Other Costs	3.7%	6.5%	0.1%

distribution and retrofitting category. It is indicated that for desired results in lighting retrofits, this category of costs must be less than 1% of the total costs (Hayashi *et al.,* 2010).

INTERVIEW RESULTS

Interview with end users

Structured interviews indicated that poor market penetration of lighting retrofits with % acknowledged use of the conventional incandescent bulbs, though majority (65 %) used CFL fittings. Only 19% used LED type fittings. However, the study did not inquire as to whether there was mix/cross cutting usage of all types of lighting fittings. Close to 60% and 50% were supplied with lighting retrofit fittings from the hardware outlets and local supermarket chains respectively. This indicated that substantial lighting retrofits were sponsored by electricity end users. A vast majority of end user indicated that electricity was very costly and agreed that lighting retrofitting were costly. This is indicative that the end users were aware of retrofitting benefits but initial costs were prohibitory. This was confirmed by over 90% of the respondents who also agreed that cost based incentives were needed to alleviate this phenomenon.

Interview with Energy Service Companies (ESCOs) AND ESKOM STAFF

The ESCOs were specifically perturbed by the fact that the financing and project approval processes were very lengthy and took between 2-3 years. This was further exacerbated by the fact that the financial procedures were unclear and were often

characterised by unfavourable payment terms. The ESCOs representatives also decried lack of information, conflicting interests amongst stakeholders and complicated contractual arrangements as hampering their operations. Also mentioned was worrying cases of inefficient management structures and lack of capacities amongst the ESCOs and Eskom. Eskom staff strongly lamented the long period of monitoring and evaluation and apparent diminished capacities amongst ESCOs.

Interview with Supplier

The suppliers indicated that they distributed the items top local supermarket outlets and that financial incentives were required to entrench energy efficiency. Apart from supplying the lighting fittings, the agency was also involved in educating the public on the benefits of their technologies. They were also lobbying for the ban of the traditional incandescent lighting fittings. According to the respondent awareness is created mainly by means of advertisements and training. The supplier ensures that all advertisements and training schemes are mainly based on energy efficiency and energy efficient retrofits. The supplier hopes to be the first company to initiate the much anticipated ban of the incandescent globe. It was also confirmed by the supplier that cost was an inhibiting factor to adoption of energy efficient lighting fittings. Also confirmed was that end users were concerned about lighting quality from the energy efficient lighting retrofit fittings.

Retail Costs

A survey of the market outlet chains (supermarkets and building hardware shops) indicated that the purchase cost per unit CFL lighting fittings was R30 (approximately EUR 5). LED lighting fittings retailed at R 180 (approximately EUR 30). Given the fact that interview with ESCOs indicated operational and administrative headaches and process related difficulties, the cost incurred on programme management was considerable and in general the transactional costs could be maximal. Further on, taken that South Africa does not manufacture CFLs, the costs associated with franchising, market set-up, testing, legal representation and agency issues may be on the higher side. This is very far from the ideal case recommended by Hayashi *et al. (*2010).

CONCLUSIONS

It is confirmed that transactional costs is a major hindrance to lighting retrofitting. It is particularly confirmed that the lengthy financial approval processes greatly slowed down participation into retrofitting programme by ESCOs. The interviews particularly confirm the observation by Mundaca and Neij (2006) that transactional costs are most prominent during planning, implementation and monitoring and evaluation phases.

RECOMMENDATIONS

As a way of alleviating prevailing transactional costs, emphasis should be made to hasten bureaucratic processes in the processing of documentation, monitoring, evaluation and verification process. This would ensure faster turnarounds for project financing apart from reducing the associated risks related to delays and uncertainty. In the end the transactional costs could be considerably reduced. Further studies are recommended to establish the actual transactional costs with greater certainty and accuracy.

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AN EMPIRICAL ANALYSIS OF COST, INVESTMENT AND RETURNS ON SPENDING ON PREVENTATIVE HEALTH AND SAFETY BY CONSTRUCTION FIRMS

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ABSTRACT

There is debate amongst construction professionals about whether resources used to promote preventive health and safety in the workplace should be considered a cost or an investment. Money spent on preventative health and safety is distinguished from rectification expenditure, which is incurred after incidents or accidents arise. Various attempts to shed light on the debate by measuring returns on preventive health and safety spending remain elusive. Whilst there is some evidence that spending does yield returns, many professionals seem to doubt the validity of the measure of such returns. Thus, the research question; is spending on preventative health and safety a cost or an investment? Construction firms that consider spending on preventive health and safety as an investment may reap the benefits of cleaner sites, better motivated workers, better productivity and thus better profitability. The paper is based on a literature review and an appraisal of case studies of firms that have invested in preventive health and safety measures. It is a supplementary research and part of an ongoing PhD study that seeks to appraise the effects of investment in health and safety in the UK construction industry.

Key words: cost, health and safety, investment, returns.

INTRODUCTION

Ordinarily, spending on an item or services rendered is worthwhile as long as the benefits it brings exceed what was initially committed or spent. But the economics behind construction firms spending on preventive health and safety has been characterised by absurdity, confusion and elusiveness (Young, 2010). Whilst there is evidence that such spending does yield returns, there also seems to exist economic scepticism amongst many professionals in the construction industry on whether such spending be considered a cost or an investment.

Lee (2011) affirmed that, 'it is important for entrepreneurs to distinguish what elements of their endeavour be considered costs versus investments, even outside of sheer cash ... how one views a particular element changes drastically how one values and perceives its potential'. The value preposition attached to safety spending may influence the amount committed (Dorman, 2000). Bailey *et al* (1995) argued that,

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'committing organisation resources to improve health and safety is not an investment, because health and safety is a public good and desire which cannot be obtained through the normal market economy (return on investment) mechanism'. This assertion may be interpreted to mean that resources used to improve (preventive) health and safety cannot be measured based on normal market indices *per se*.

But economists and modernists are of the view that resources committed to health and safety is an investment, as long as such spending yields returns. For this reason, Hughes and Ferret (2007) claimed that 'safety is without doubt the most crucial investment that can be made, and the question is not what it costs, but what commitment to health and safety saves for organisations'. Moreover, the saying that 'health is wealth' ordinarily portrays resources committed into preventive health and safety as an investment. This can be corroborated by the Health and Safety Executive's (HSE 2011) assertion that 'investment in healthy people yields healthy businesses'.

Culyer *et al* (2008) argued that it is difficult to measure directly returns on resources committed into preventive health and safety; 'however there are basically three ends of returns to investment in occupational health and safety, namely: (i) such investment improves health and well-being, (ii) inherent value of greater security, and (iii) improved productivity'. This seems to justify the claim by Waterman (2012) that 'managing health and safety well is not a cost, it is an investment'.

LITERATURE REVIEW

There are no authoritative definitions of the terms, 'spending on preventive health and safety' and 'investment in health and safety'. However, the HSE (2008) asserts that, improving health and safety practice through commitment to safety is an investment because it enhances well being, productivity and profitability. The HSE (2008, 2009a) further highlights the following as investments in health and safety:

- ☐Commitment to safety budgets
- ☐Quality of risk assessments
- ☐Robustness/appraisal of safety policies and procedures
- ☐Commitment to safety plans, quality health and safety accounting statistics
- ☐Commitment to safety training
- ☐Engaging quality staff
- ☐Sub-contract vetting processes
- ☐Evidence of health and safety integration within the supply chain
- ☐Safe methods of working
- ☐Safeguarding of equipment
- ☐Commitment to use of PPE

Koper *et al* (2009) stressed that for spending on 'health and safety to be deemed as an investment, it should contribute significantly to performance aspects such as overcoming absenteeism, overall cost reduction, productivity and profitability.' Bailey *et al* (1995) argued that, 'ultimately investment should yield returns and can be measured using cost benefit analysis; because investment is often linked to numerous advantages which include process efficiencies, reduced cost and staff retention.'

The difference between cost, investment and return from spending on preventive health and safety

According to Lee (2011) 'there is significant difference between cost and investment'. Cost is a reference to the total money, time and resources associated with a purchase,

activity or service rendered,' and 'an investment is a reference to the use of money for future profitability'. Lucy (2009) argued that, it is somewhat difficult to distinguish between characteristics of a cost and an investment. However, using the q theory economic model put forward by Abel and Enerly (2002) which states that, 'optimal investment is dependent on both expected returns and costs of capital', attempt is made to differentiate between characteristics of cost and investment as illustrated below:

Difference between cost and investment using q theory economic model

Characteristics of cost	Characteristics of investment
☐ Cost is fully identified with product or services	☐ Investment is synonymous to commitment or deals that yield return
☐ Cost does not mean the same thing under all circumstances	☐ Under normal circumstance investment should yield return
☐ Cost of item may not be true, exact or the accurate amount paid for a product or service	☐ Investment is often driven by intention to make profit
☐ The composition of what constitutes cost differs under different circumstances	☐ Investment compositions are usually well spelt out, unlike cost that differs under different situations
☐ Different methods are often used to ascertain what constitutes a cost	☐ In most cases, it is market forces that control the outcome of normal investment
☐ Cost varies with time, volume, method or purpose	☐ Investment is synonymous to future purpose (gain)
☐ Cost is expenditure which may be actual or estimated, direct or indirect and should be related to a job, product, process or service	☐ Investment can be direct and indirect. It may be linked to training and development of product and services
☐ Customarily, to some extent cost has the traits of been subject to control	☐ In an ideal situation, investment should help reduce cost
☐ Cost is the opposite of revenue	☐ Divestment is the opposite of investment
☐ Cost must not necessarily yield return	☐ Most investment is valuable
☐ Investors usually minimise costs in order to maximise outputs.	☐ Investor's need to invest is usually influenced by 'pay-back time' and yield (returns)

Investments usually have more risk involved, but also could lead to more profitability (or reward) in the long run. Good investments should yield returns and are often driven by intentions to make profit. Bradley (2011) asserted that the performance measure used to evaluate the efficiency of an investment is often referred to as 'return on investment' (ROI). To calculate ROI, the benefit of an investment is divided by the cost of the investment; the result is expressed as a percentage or a ratio using the following formula:

$$\frac{\text{Gross income - Cost of investment}}{\text{Cost of investment}} \text{ X } 100$$

Additional economic measures such as pay-back time, which is the length of time required to recover the cost of an investment can also be used to determined effectiveness of an investment. Arguably, it is relatively difficult to use these economic models to calculate return based on investment or spending on preventive health and safety, because of the non-ring fenced nature of such expenses. For

instance, in practice money allocated for preventive health and safety in construction projects can be spent on diverse activities such as provision of scaffold, staff safety training, site security, cleaning of sites and hygiene facilities. Therefore, it is difficult to 'pin down' spending on preventive health and safety to a particular project cost centre nor can it be used effectively to measure ROI or pay-back time on commitment to health and safety. Perhaps, this may have informed thinking of the Royal Institution of Chartered Surveyors (RICS) not to include in its standard methods of measurement (SMM), pricing of health and safety activities as a stand-alone or separate item. Nevertheless, it should be mentioned that construction contractors do have bespoke means of adding money to preliminary items in Bills of Quantities, to allow for preventive health and safety in construction projects.

Hence, Culyer *et al* (2008) is of the view that, the challenges of not having appropriate economic models that can be used to measure accurately returns on spending on preventive health and safety using quantitative measurements may have contribute significantly to the difficulties associated with ascertaining whether spending on preventive health and safety is a cost or an investment. In this regard, the Occupational Health and Safety Administration (OSHA 2009) claimed that the economics behind spending on preventive health and safety is contentious, due to imprecise measurement and different viewpoints on whether such spending is a cost or an investment.

Dorman (2000) affirmed that 'expenditure used to improve working conditions is an investment in a strict economic sense; it is cost borne in earlier periods in order to reap benefits in later times'. On the other hand, it may be deemed inappropriate to consider spending on preventive health and safety using normal market investment parameters; because in terms of financing an investment, the loans from which normal market investments are made are usually collateralised by the assets the investment purchases or produces, such as equipment, material, patents and stocks of finished and part-finished goods. But the main asset under consideration in term of commitment to health and safety is human capital and workers cannot be offered as collateral. Firms do not actually own their workers, of course; they only rent them. As a result, all investments in human capital, including commitment to health and safety, are likely to be subject to adverse discrimination in financial markets (Koper *et al*, 2009). Thus, Dorman (2000: 9) in an articulate analysis acknowledged that 'investment in occupational health and safety has certain deficiencies that cause problems in the process of economic evaluation. These deficiencies (unequal distribution of costs, benefits, problem with perception and quantification) lead to lower levels of prevention than economically feasible, even at the enterprise level.'

In this regard, Culyer *et al* (2008) subsequently affirmed that the measure of commitment to health and safety against return or organisational profitability remains a challenge to the study of health and safety economics. This inherent difficulty seem to inspired most literature to base economic measurement of commitment to health and safety solely on cost benefit analysis, with little or no attempt to measure investment in health and safety directly with organisational profitability. The most recent study regarding cost benefit analysis on commitment to preventive health and safety was conducted by the International Social Security Association (ISSA 2011) which stated that 'the goal of prevention accounting is to calculate the microeconomic effects of occupational health and safety in terms of qualitative and quantitative metrics ... achieved by developing a cost benefit analysis ... using an ordinal scale that is suitable for qualitative observations', as illustrated in table 1.

Table 1: Prevention costs and benefits for companies; adapted from ISSA (2011)

Prevention costs (for companies). Value in EUR per employee per year		**Prevention benefit (for companies). Value in EUR per employee per year**	
Personal protective equipment	168	Cost savings through prevention of disruptions	566
Guidance on safety technology and company medical support	278	Cost savings through prevention of wastage and reduction of time spent on catching up after disruptions	414
Specific prevention training measures	141	Added value generated by increased employee motivation and satisfaction	632
Preventive medical check-ups	58	Added value generated by sustained focus on quality and better quality of products	441
Organisational costs	293	Added value generated by product innovations	254
Investment costs	274	Added value generated by better corporate image	632
Set-up costs	123		
Total costs	1,334	Total benefit	2,940
Cost-benefit on return of ROS ratio: 1:2.2.			

METHODOLOGY

The study research methodology is based on a literature review and an appraisal of eighteen case studies which illustrate various levels of commitment to spending on preventive health and safety; they are taken from information obtained from a HSE data base (HSE 2009a and 2009b). Details of seven out of the eighteen case studies are presented. Four are SMEs and three considered as large firms, as illustrated in table 2. Detailed analysis from data obtained shows that, commitment to health and safety yields returns that includes cost reduction, increased production, increased efficiency, improvement in equipment reliability, enhancement in worker trust and reduction in Accident Frequency Rates (AFRs).

FINDINGS

Findings from these case studies provide further evidence that resources committed to preventive health and safety are intertwined with other production activities and hence there are diverse returns on investment in safety (ROIS). Furthermore, findings from this study show that, the need to invest in preventive health and safety is meaningful to both large construction firms and also SMEs. It also suggests that, SMEs that invest in safety measures tend to have better savings from insurance premiums compared to large companies. This therefore means that, lack of commitment to safety can lead to negative safety image with the tendency to increase SMEs insurance premium.

Table 2: Investment in health and safety and return on investment analysis

	Name of companies	**Nature of business/No. Of employee**	**Nature of investment in safety**	**Approximate cost of investment in safety (£)**	**Gain from investment in safety/annual (£)**	**Return on investment in safety(ROIS)**
1	Data Scaffolding Services Ltd - UK	Construction - NoE 8	Employment of an external safety advisor and investment in high quality scaffolding	30,400	Saved approx. 21,000 from reduction in insurance premiums and others benefits	60% saving on insurance premium and increase in production efficiency
2	Ibstock Brick Ltd - Sussex, UK	Production of bricks - NoE 50	Investment in safety training and equipment	270,000	Saved approx. 20,000 quarterly and other benefits	25% reduction in days lost and increase of 1.5% in brick production
3	Dolphine painters. Dorset, UK	Construction internal finishes - NoE 20	Investment in new equipment, altering existing equipment and staff training	£5,000	15% reduction in overall operation costs and other benefits	15% reduction in operating costs. No employer liability claims
4	Huntsmans Quarries Ltd, Gloucestershire, UK	Construction - NoE 40	Training of staff and invested in staff welfare	£270,000	Saved approx. 20,000; increase in production and other benefits	5% increase in productivity and reduction of employer liability costs by 30%
5	Birse Rail Ltd, UK	Railway Construction - NoE 800	Invested in safety training and equipments	£135,000	Saved 16,200 per annum from increased efficiency and other benefits	69% reduction in AFRs from 0.64 (2001) to 0.20 (2002) per 100 hours worked
6	Edmund Nuttall Ltd, Wales and Scotland	Civil engineering Construction - NoE 2,500	Training and equipments	£92,000	Saved approx. 15,640 monthly from workers' absenteeism	Staff turnover reduced from 62% in 1999 to 33% in 2002
7	Wilson James, Essex, UK	Construction - NoE 500	Invested in worker well-being	150,000	Saved approx.14,000 per annum from insurance, and other remedial safety costs	Reduction in lost time, workers felt valued, gained worker trust

DISCUSSION

Motivating factors for spending money on health and safety are fear of the law, fear of being sued, fear of negative publicity and potentially higher insurance costs. The issue is not therefore whether expenditure on health and safety is implicitly made to secure a financial return, but whether this expenditure, albeit initiated to ensure compliance with the law, invokes spin-off into other spheres of business practice (such as cleaner sites) that consequently leads to enhanced profitability. Findings from this study indicate that commitment (investment) in preventive health and safety is good business (HSE 2008). However, the financial benefit in terms of organisational profitability emanating from investment in preventive safety practice appears to be intangible and difficult to measure. Also it could be argued that, the non-ring fenced nature of health and safety expenses used to provide preventive health and safety seems to exacerbate difficulties in establishing the relationship between costs, investment and returns on preventive health and safety paradigms. However, there is need to advance research on the role of organisations' commitments to health and safety and develop a sound business case for commitment (investment) in health and safety with regard to organisation's success (profitability).

CONCLUSION

The general view about spending on preventive health and safety seem to portray such expenses as an investment; that is, returns on investment are not considered as a factor when decisions are made about whether spending on health and safety should proceed. From the point of view of quantity surveyors or estimators, spending on preventive safety is arguably deemed as a cost, since contractors include money in tenders to take care of spending on preventive health and safety without being able to measure tangible financial returns. On the other hand, it is argued that the amount budgeted and spent on preventive safety may be used as an indicator of the commitment of organisations to health and safety, and such spending can be used as a parameter to determine the degree of safety in organisations.

Finally, it seems that in accounting terms, it is not appropriate to classify preventative health and safety expenditure as an investment. However, retaining the term 'investment' may be a useful semantic tool to be used to lever managers to spend as much money on health and safety as is reasonable. In all, what seems to be clear is that organisations that are committed to spending on preventive health and safety do reap numerous and varied returns, with the possibility of boosting overall productivity and profitability. Future work will seek to correlate investment by companies in health and safety best practice with profitability reported in externally reported annual accounts.

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FIRE SAFETY IN BUILDING USAGE CONVERSION IN JOHANNESBURG, SOUTH AFRICA

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ABSTRACT

Conversion of existing buildings from one type of usage to another inevitably has a wide range of implications such as whole building performance, energy efficiency and fire safety. Results of a pilot study to address fire safety issues in building usage conversion are presented in the paper. The study is focused on fire safety issues related to the current trend of converting older commercial buildings to residential use, in Johannesburg South Africa. A select number of issues were investigated in relation to fire safety and protection of such buildings. Issues considered include provisions for fire protection; effectiveness of approval process; compliance inspection, supervision and monitoring; new occupancy; depth of fire safety awareness and training by relevant parties. The research objective essentially addresses fire safety implications of occupancy change and conversion of building spaces and sub-systems; in relation to current practice in South Africa. Findings thus far suggest existence of lapses in design provisions for fire safety; lapses in the approval process and capacity issues with existing monitoring systems. Other areas highlighted include fire safety equipping of buildings; training and awareness of facility management and occupants.

Keywords: building conversion, compliance, fire safety, monitoring, regulations.

INTRODUCTION

The research interest here is in fire issues about conversion of building usage in South Africa. The study represents a combination of concepts from building science, building performance, fire safety and protection in buildings, building regulations, housing, and adaptive re-use of buildings. Conversion of buildings from one type of use to another, should comply with regulations for upgrade of buildings. Such codes emphasise fire safety issues. Other aspects of the building are also expected to comply with relevant codes. In addition alterations are expected to result in improvements of fire safety provisions in such buildings. Compliance approval for such provisions emanates from regulatory bodies (Powell, 1990). Building conversion refers to the recycling or alteration of a building structure to suit a different purpose other than the original designed usage. Building usage conversion is a trend in the world, where it is mainly employed for revitalisation of cities. Examples include conversion of office

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buildings to residential use (Cook and Hall, 1997). Conversion of buildings plays an important role in helping to meet growing demands for residential accommodation. It is also considered an adaptive re-use, which is a sustainable option for promoting urban growth. In addition conversion increases the number of households living in city centres. Such increase is considered a strong factor in realising social, economic and environmental development goals (National Centre for Environmental Health, 2000). However in converting buildings, non-compliance to fire safety is addressed through improvements. Thus such facilities should have compliance approval (Powell, 1990). Importance of compliance is symbolised by research showing that building conversion is a major cause of fire outbreak (Barlow and Gann, 1996). Fire safety and protection in buildings concerns the prevention and reduction of fire hazards such as death, injury, or damage to property. Fire protection increases the chances of survival for users, in the event of fire (Blossom, 2002). Consequently codes, regulations and ordinances have been developed over time to guide provisions for fire protection in buildings. Such provisions vary according to climatic zones, types and location of buildings, and interior spaces. It also involves the use of both passive and active designs, and artificial components (Ogus, 2004). Therefore fire safety status of converted buildings should be a major consideration, in re-design and implementation. However, fire outbreak in converted buildings remains a key barrier to expected business growth. Research suggests a need to address fire implications of usage conversion in building regulations of most countries. Addressing fire safety issues in this case should ultimately achieve full compliance of such buildings (Millward, 1994).

USAGE CONVERSION AND FIRE IN BUILDINGS

Building usage conversion, especially the conversion of office buildings to living spaces (residential buildings) has been in occurrence since the 1970s. It has been viewed as a cost-effective way of renovating and re-using old building stock (Homebuilding and Renovating, 1999). Essentially building conversion has been an answer to the high vacancy rates of office buildings in cities within places such as the Netherlands, Germany and UK. Thus it is viewed as prudent to apply adaptive re-use by converting commercial buildings to residential purposes or mixed use. Usage conversion brings sustainability to the context. It affords savings in construction time, re-use of materials, and reduction of impact on natural resources (Hilde and Van der Voordt, 2007). In addition it is used to address shortage of residential building supply (Millward, 1994). Furthermore conversion is preferred on economic grounds, to erecting new structures (Yoshimura, 2000). In France and UK vacant offices and other facilities have been converted to other uses, especially residential (Feinstein, 1995). Older office and public buildings which are converted, hardly comply with modern fire protection standards. Areas of non-compliance include unsuitable stairway design, narrow or dead-end corridors, narrow doors, wrong swinging doors, and unrated materials. Such issues need to be addressed in relation to local codes, for approval and occupation of converted buildings. Adaptations made necessary by such needs present challenges to stakeholders such as owners, builders, architects and other consultants (Fall, 1997). Research shows examples of severe fire outbreaks which are linked to building conversion in cities such as London, Toronto, Sydney, and Virginia in the USA (Barlow and Gann, 1996; Millward, 1994).

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Fire safety, protection and compliance in buildings

Principles of fire protection in buildings refer to active, passive and structural measures; which are incorporated in planning and design, and subsequently built into the structure. The aim of fire protection is to arrest and limit consequences of fire outbreak, and protect the building structure, contents and occupants. Fire protection in buildings addresses fire spread control, fire escape and fire-fighting access (Stollard and Abrahams, 1999). In so doing, fire behaviour of building materials utilised and contents of the building are considered. Areas of scrutiny include ignitability, combustibility, flammability, potential heat production level, smoke and combustion gases production potential, surface spread of flame, volatility of the material aflame, and smoothness and density of the material. In addition fire resistance of building elements are also considered. Stability, integrity and insulation capacity of each element are used for rating each element or component (Shields, and Silcock, 1978). Other important factors include fire detection and extinction (Yatim and Harris, 2005). Furthermore there is need for awareness, fire safety consciousness and training of occupants (Stollard and Abrahams, 1999). It is arguable then that such complex considerations are necessary, especially when a facility is converted from one usage type to another.

Usage conversion and fire safety of buildings in Johannesburg

Building conversion in Johannesburg is a trend that seems to have started in the late 1980s and early 1990s (Health, Housing and Urbanisation Directorate, 1992). It is reported as a part consequence of housing problems. Such housing issues are traceable to the housing needs of the urban poor in most developing countries (Gilbert, 2000). Rapid increase in conversion of commercial and industrial buildings to residential use has followed inception of democracy in South Africa. Conditions of such buildings are known to be sub-standard and hazardous to life, with overcrowding (Crankshaw and Gilbert, 2000). In addition the city has a large collection of mostly commercial and old building stock. Prolonging their life and usefulness usually requires modifications; some of which are aimed at bringing fire protection provisions up to prevailing standards (Richardson, 2007). In the City of Johannesburg; vacancy, rise in vandalism, structural decay, blight and devaluation of buildings constitute economic and social reasons for usage conversion (Accordino and Johnson, 2002). Thus building conversion has continued, with existing projects and planned ones running into multi-billion Rands collectively (Fraser, 2007). Opportunities and incentives to convert buildings exist in the form of relaxed zoning and property tax reductions. While such developments benefit stakeholders in the short term; the resultant overpopulation increases risk of fire among others (James, 2010). Building conversion is said to increase potential for slow transition within exit stairs. It has also been linked with difficulties in launching both exterior and interior fire fighting due to poor access (Fernandez, 2001). Other possibilities include obstruction of emergency routes in the course of occupancy and non-compliance in placement of fire safety signs (Richard and Sarah, 1981). Further challenges include the occupants, especially with regard to behavioural patterns of different people in fire emergencies (Colonna, 2001). Furthermore inspection and approvals by fire protection authorities are necessary for plans relating to all aspects of the building. The process includes monitoring of the project and post-renovation inspection, prior to issuance of fitness certificates (Butcher and Parnell, 1979). However there are barriers to effectiveness in enforcement of regulations, such as shortage of skills, administrative conflicts, and corruption (Listokin and Hattis, 2005).

Considering the discourse thus far, the trend of building conversion in the city of Johannesburg South Africa, poses the risk of fire incidents in the city. On this background, the research questions standards and provisions for fire protection in such city buildings; enforcement of regulations and occupancy implications. Thus a pilot study was designed to investigate fire safety issues in converting commercial buildings to residential use in the context of Johannesburg, South Africa.

METHODOLOGY

Considering findings from literature, and within the scope of study; there was need for the following: to review the fire safety requirements and provisions in the South African Bureau of Standard (SABS 10400), for converted buildings; to compare fire safety standards for commercial buildings with residential buildings; to examine the role of building inspectors and barriers to their effectiveness; and to examine fire safety awareness, training and compliance, of facility managers and occupants. In addition the following constructs were explored: Provision of fire protection in converted buildings; regulation and enforcement of fire safety compliance in the conversion of buildings; and awareness and training, with regard to fire safety implications of converted buildings. Responses to survey questionnaire and interviews are used to explore constructs. A combined approach was adopted for data collection and analysis, essentially employing interpretive and descriptive approaches (Creswell, 2003). Furthermore, since the study is focused primarily on buildings which were linked to various stakeholders; a considerable sample of buildings was utilised. Information could then be gathered from various sources to achieve a measure of validation and triangulation. Techniques utilised were documentary analysis, field observation, use of questionnaire and interview (Creswell, 2003).

DATA ANALYSIS AND FINDINGS

Ten (10) multi-storey buildings converted from commercial to residential use within Johannesburg city were initially selected. Based on willingness of occupants to participate, eight (8) buildings were eventually utilised for the study. Out of 120 questionnaires distributed equally, 93 were completed and returned; giving a response rate of 77.5% = (93/120 x 100). In addition interviews were conducted with facility managers of the eight buildings studied. Furthermore ten (10) members of the Johannesburg fire department were interviewed according to their divisions. The list includes the director, station commander, inspectors, the fire fighting team, and head of building team. Field observations were also performed on the eight buildings for validation of data. Descriptive statistics was used for the preliminary analysis presented in the paper. Proportions of respondents in the form of percentages and averages of percentages are used to describe analysis results. Summary of analysis and findings are presented in narrative form.

Results of exploring constructs

Under provision of fire protection in converted buildings, which was explored with facility managers and occupants; a 63.5% average of respondents indicated poor conditions in their buildings. For regulation and enforcement of fire safety compliance; while the fire department claims to be performing their duty, 63% of responding occupants indicated that inspections do not occur. With regard to awareness and training for fire safety; 100% of respondents (facility managers and occupants), indicated no occurrence. Furthermore 100% of facility managers and 77%

average of occupants did not demonstrate understanding of required fire safety compliance for converted buildings. However 75% of facility managers and 61% of occupants have observed fire outbreak on their buildings. In addition 75% of both classes of respondents indicate that occurring fire outbreaks were severe, causing injury to users.

Results according to sources of data

With regard to the local regulations (SABS 10400 of 1990); express provisions for fire safety and protection in converted buildings does not exist. The only guide is in the form of classifications used to direct implementation for peculiar building and occupancy types. Buildings are classified according to various occupancy types, with different fire hazard categorisations. While occupancy types range from class (A) through class (J), fire hazard categories range from low to moderate and high. In the absence of specific codes for the peculiarity of building conversion, the city of Johannesburg has by-laws for fire safety provisions in such buildings. However, only fire fighting equipment, escape routes and structural integrity are provided for in the by-laws. The approval process consists of submission of plans and drawings of conversion work, which are crosschecked for the stated provisions. Converted buildings which satisfy above mentioned requirements are issued certificates of compliance. However compliance needs to be enforced by the city fire department. The legal frame work for controls provides for regular inspections to check for any non-compliance that poses fire threats. Clearance certificates are issued when the conditions are met while legal action is instituted for non-compliance.

The fire department is aware that adaptive re-use of buildings is a continuing trend, due to high demand of residential accommodation in the city of Johannesburg. From their experience usage conversion increases the risks of fire outbreak in buildings within the city. In addition, various forms of fire safety non-compliance are observed during their inspections. Observations include poor management of designated fire exits. However the department faces major manpower and skills shortage, which affects its law enforcement capacity. As such effective commissioning, inspection and monitoring are hampered.

Facility managers interviewed on the other hand did not understand the fire safety implications or fire protection provisions of the buildings they managed. Furthermore they did not demonstrate understanding of fire safety regulations for the buildings and necessary compliance by occupants. They only recognised the provision of exit routes and fire fighting equipment following further elucidation during data collection. At this point, they also shared a common submission about the need for further compliance in their buildings. Moreover they did not conduct fire safety awareness and training for occupants.

On the part of occupants, there is virtually no awareness of the fire safety implications of the buildings they are occupying. While majority know that they occupy converted buildings, they do not know enough to relate to parameters of fire safety compliance which such buildings should adhere to. Other areas include lack of fire safety awareness and training. There were also no fire drills recorded. Majority complained of poor performance by facility managers and the fire department. Claims suggest that inspectors have not visited buildings under study since inception of the current occupancy.

Discussion

Generally there is evidence from respondents that fire outbreaks have occurred in converted buildings researched. Some of the outbreaks were reported as being major. Secondly there is lack of capacity with stakeholders researched. To substantiate the claim, findings show that the fire department is in need of skilled manpower. Facility managers also require adequate training in this regard. Occupants similarly need proper education with regard to fire safety and the peculiarity of the buildings they occupy. Thirdly while all parties agree to the use of pamphlets and leaflets for creating fire safety awareness, it was not implemented in any of the cases studied. Fourthly behavioural patterns of occupants were suggested as the main cause of fires. However occupants are dissatisfied with the degree of fire safety performance by building owners and the fire department. Furthermore there are disagreements between the parties with regards to the effectiveness of inspection and monitoring. Field observations confirmed the less than desirable fire protection status of the buildings researched. Problems seem to emanate from the conversion, usage and management of these buildings. Aspects such as stairways, corridors, signage, exit routes and escape outlets were called into question.

CONCLUSIONS

In conclusion, the paper is part of wider research agenda in building science, focused on fire safety. Data presented here is part of a degree project, on which limitations of time and scope were imposed. Data on identified causes of fires in buildings studied could not be obtained. Also access to all relevant parts of each building was not possible. However, main discoveries of the study so far point to a number of gaps in the execution, administration and regulation of building conversion, and its usage in Johannesburg city. In response to the guiding questions, findings suggest possible lapses in the following areas: design considerations for fire safety, the approval process, and lack of capacity in the monitoring system in place. Furthermore training and awareness, on the part of facility management and occupants are questionable. Deductions at this time lead to a number of propositions, which are stated below.

1. Building usage conversion increases the risk of fire in buildings within Johannesburg city. Also most buildings converted from commercial to residential use do not comply with fire safety regulations and the city by-laws
2. Most occupants in converted buildings within the city of Johannesburg are not familiar with building fire protection compliance needs. They are not fire safety aware and have not been trained with regard to fire emergency procedures. As such overcrowding, unit sharing by multiple families and poor housekeeping, are some key causes of fire in converted buildings within Johannesburg.
3. Stakeholders involved in converting buildings, cope with the challenges by avoiding certain areas which are not easily discovered during the approval process. Furthermore considerable amount of usage conversion occurs in Johannesburg without approval.
4. Johannesburg city fire department lacks the manpower in terms of volume and skills to adequately enforce the national regulatory demands and city by-laws, for fire safety and protection in converted buildings.

5. National regulations and additional city by-laws on building usage conversion do not address all peculiarities of building conversion; which could be linked to fire.
6. Most facility / building managers of converted buildings within the city of Johannesburg are not adequately trained, with regard to fire safety requirements, compliance and procedures.

Though not exhaustive, the above stated propositions present basis for subsequent research in the focus area.

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Procuring Indigenous Social Housing In Australia: A Case Study Of The Project Alliance Approach

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Abstract:
Indigenous Australians in remote areas of the Northern Territory (NT) are subject to poor living conditions. This is a common problem and the development of sustainable social housing has become a significant challenge. Various procurement models used for project delivery have failed to address problematic issues that have led to poor health and reduced life expectancy amongst the indigenous population. Project delivery models for social housing are in need of reform to overcome the mounting problems and disadvantage in these indigenous communities. A current State and Federal Government initiative is the Strategic Indigenous Housing and Infrastructure Program (SIHIP). This program is using an Alliance procurement approach to deliver the planning, design and construction stages for social housing. Project Alliancing provides value for money, develops trusting relationships, appropriate management of team goals, multi-disciplinary expertise and innovative solutions for successful project delivery. Alliancing is characterised by project arrangements that ensure that risk is shared across all stakeholders under a pain/gain-share system to overcome adversarial and inefficient traditional contractual approaches. Using a case study approach, this paper analyses the SIHIP Project Alliance framework and focuses on principles for successful project delivery. The SIHIP has delivered sustainable housing projects for indigenous Australians and was particularly successful with regards to adaptability, effective program management and providing sustainable practices.

Keywords:
Australia, Indigenous Culture, Procurement, Project Alliancing, Social Housing.

1 Introduction

Effective management and use of resources throughout the entire construction process is the key to producing a successful product in the built environment (Harris et al, 2006). Project success is influenced by the procurement approach that provides a framework for all the aspects of construction to be holistically brought together (Walker, 2008). Therefore, procurement strategies can effectively drive the success, efficiency and sustainability of a construction project, and it is this that influences the aim of this paper within the context of identifying issues with the procurement of adequate and appropriate housing for remote indigenous communities. The provision of indigenous

social housing has been identified as a significant problem throughout Australian history. The likes of Memmot (1989), Pholeros (1993) and Read (2000), discuss the social, political and cultural problems with the construction and provision of houses in the remote Northern Territory (NT) of Australia.

Cheung at al (2005), Jefferies et al (2006), Walker and Hampson (2008) identify recent procurement innovations which have led to the development of contracting frameworks that aim to address the increasing nature of change and complexity of the construction industry. Formed around characteristics that develop relationships, share risk, drive collaboration and develop innovative solutions, Project Alliancing is a contracting system that embraces change, adapts to obstacles and enables participants to work together to achieve increased project performance and improve outcomes. It is the implementation of a Project Alliancing framework for the delivery of remote Australian indigenous housing (IH) in the Strategic Indigenous Housing and Infrastucture Program (SIHIP) that forms the basis of this paper.

Subsequently, the aim of this paper is to:

"Evaluate the SIHIP Project Alliancing procurement model in delivering cultural, economic and socially successful outcomes for Indigenous Housing."

The problems associated with indigenous housing are significant. Evidence is wide spread with overcrowded houses, poor performance of utilities, lack of maintenance and deteriorated, unsafe buildings (Pholeros 1993), (ABS 2006), (FaHCSIA, 2007), Indigenous Australians in the remote areas of NT have the lowest socio-economic profile of all Australians. The NT's Department of Local Government and Housing, in identifying problems with current IH, have proposed a solution which involves the use of different procurement models to provide adequate housing and services to remote indigenous communities. The development of the SIHIP led to the choice of Project Alliancing as the most effective contracting method for successful delivery of IH (FaHCSIA, 2009). Therefore, drawing on issues of remote IH and the successful attributes of Project Alliancing, this paper evaluates the success of the SIHIP in solving common problems with the provision of social housing in NT indigenous communities.

2 Indigenous Housing in Australia

The quality of housing and related infrastructure has always been a primary determinate of indigenous disadvantage, particularly in remote communities. The 1970s saw the first official identification of these issues and served as an element of concern for the living conditions, health and overall social wellbeing of the indigenous Australians. Rowley (1971) described housing as an issue decaying the standard of living of many remote aboriginal communities and the poverty, lack of education, violence and poor health was attributed to the primary issue of insufficient and inappropriate housing. Similar conclusions were drawn by Heppell (1979) along with the need for improved government policy aiming at the need to develop long-term strategic solutions to solve the problems with remote IH.

Both Memmott (1990) and Saunders (1990) provided an insight into housing policy for indigenous Australians and they covered the need for both state and federal policies to

understand the specific need for housing development. This related to holistic provision including design, construction and delivery of the projects that would be appropriate to the needs of remote Indigenous communities by paying specific attention to culture, living standards and sustainability. The situation in recent years has continued to be problematic with issues of overcrowding, low quality construction, poor planning, and lack of basic services and utilities (ABS 2002; Jefferies et al, 2011). Government reviews of IH programs also confirmed these problems, and not only with the housing itself, but also with the method of delivery. Specifically these reviews highlighted poor construction, lack of maintenance, inexperienced housing management, fragmented housing organisations and an inappropriate allocation of funding (FaHCSIA, 2007). Pholeros (1993), Read (2000) and COAG (2008) all identified the need for an improved system of procurement involving industry, government and community partnership in order to develop solutions to improve the day to day living environment. Reference has even been made to developing a specific section of the Building Code of Australia (BCA) for indigenous and remote housing and infrastructure (AIHW, 2005).

The current SIHIP is utilising almost A$700M of funding and is the largest IH program undertaken by the Federal Australian and NT State governments (FaHCSIA, 2009). The primary aims reflect those of similar policies and past programs, with additional objectives to improve remote indigenous built environments through the construction, rebuild and refurbishment of houses.

3 Project Alliancing

Construction projects are dynamic, ever changing and inherent with risks. Noble (2007) states that these levels of risk and the growing size and complexity of projects has attributed to the adversarial and fragmented nature of the construction industry. Project Alliancing aims at managing risks more effectively and encouraging collaborative and relational partnerships between stakeholders in order to better achieve project objectives and improve overall project performance. Walker (2008) also adds that Alliancing utilises the principles of risk sharing to better develop relationships and integrate the team to maximise project performance. According to the Victoria Government's 'Project Alliancing Practitioners Guide' (Dept. of Treasury and Finance, 2006), an Alliance is defined as "a commercial/legal framework between a department, agency or government-business enterprise as 'owner-participant' and one or more private sector parties as 'service provider(s)' or 'non-owner participant(s)' for delivering one or more capital works projects." Alliancing demonstrates characteristics of a partnership in that there is a collective sharing of almost all project risks and benefits, a no blame/no disputes agreement and an integrated project team personally selected who then use a principle based strategic management process. In partnership, each entity provides their services on a net cost basis and upon completion of the project the parties share in the profits and/or losses respectively.

Traditional forms of contract, such as Construct Only or Design and Construct, consist of project risks being allocated to the party believed best placed to manage the risk. The terms and conditions of traditional contracts aim at predicting all possible outcomes and assigning liability, so when changes or alterations occur, the result often ends in dispute. By comparison, Project Alliancing is built on a partnering ethos in order to embrace

collaboration, change and innovation in project delivery (Sakal 2005). Another prime characteristic of an Alliance is the early involvement of contractors and other stakeholders to encourage innovation, collaboration and allow the design, construction and occupation of the project to be integrated (Scheublin, 2001).

Alliance Contracting has been used on numerous Australian public sector capital works and infrastructure projects. To take advantage of this approach, some Australian State Governments have developed Alliance guidelines detailing the processes and framework for delivering major works. However, the use of Project Alliances to deliver building projects has been limited, the National Museum in Canberra a notable exception, and the SIHIP is one of the first major building projects to utilise this procurement system.

4 Research Methodology

Primarily, the data collected for this paper focused on published literature and secondary data. This allowed the researchers to understand the themes based entirely on the information at hand without opinion or subjectivity (Knight, 2008). The preliminary stages of research analysed current and historical literature to gain an understanding of the issue of remote indigenous housing and identified the need for a procurement approach specific to this problem. The principles of IH were established via a review of literature that identified both contributors and hurdles to successful outcomes. Subsequently developed into criteria, the principles were used to evaluate a case study of the Project Alliancing procurement system used for the SIHIP in the Northern Territory of Australia. The evaluation was based on the performance review documentation and published statistical data representing the outcomes of the SIHIP.

5 Results And Discussion: The Strategic Indigenous Housing and Infrastructure Program (SIHIP)

The Strategic Indigenous Housing and Infrastructure Program (SIHIP) is a current initiative of both the Australian Federal and NT State governments and is aimed at improving housing for indigenous Australians in remote areas of the NT. The program is the largest of its kind and SIHIP will construct new houses and refurbish existing houses in over 70 remote regions of the NT. Delivered using Alliance contracting, the SIHIP was developed to achieve the objectives of national IH policy and address the problematic issues of previous projects through timely and cost-efficient delivery.

5.1 Development of SIHIP

The SIHIP, as a part of the reform agenda outlined in the National Partnership Agreement on Remote Indigenous Housing (NPA RIH), was initiated in 2007 and formally announced in April 2008. The program replaced the previous arrangements of the Aboriginal Rental Housing and Community Housing and Infrastructure Programs following the trend of joint federal and state funding with state controlled delivery of this type of program. It was the agreement between the federal and NT governments which initiated the SIHIP in response to the recognition that previous housing programs had been unable to achieve desired outcomes (COAG, 2008). The project aimed to

address the large shortfall in housing stock, horrendous overcrowding, poor living conditions and overall community, social and economical disadvantage to the Indigenous population in remote NT (ABS, 2006).

Previous programs were failing to achieve the desired stakeholder outcomes and this prompted a change in program structure and project delivery. The general delivery method was previously standard one-off, lump-sum contract agreements, and these programs continuously failed to achieve value-for-money or the economies of scale needed for successful outcomes, particularly in unique projects such as this. Presented with a range of business and policy challenges unique to the remote Indigenous regions of the NT, such as cultural and social considerations, history, heritage, environmental and climate restrictions and limited resources, the government agreed that an alternative procurement approach may be able to achieve the required outcomes (FaHCSIA, 2009). A procurement system which provided an incentive for quality, sharing of risk, responsibility and benefits, and greater elements of indigenous employment, training and overall community development would be a significant driver for change to achieve more sustainable improvement.

The aim of the SIHIP was to deliver new housing, refurbish and upgrade existing housing, improve living conditions and provide new infrastructure and capital works. The program was initially provided with $538 million worth of funding from the Australian Government and an additional $100 million from the State Government. The NT Government delivered the program through the Project Alliancing procurement system and was also responsible for property management, rent collection and routine maintenance though its public housing framework. The Australian government would provide support throughout the program, oversee the delivery and provide governance and guidance of key decisions and the strategic direction of the program.

5.2 The Project Alliance Approach for SIHIP

Through best practice procurement, a Strategic Alliance system was adopted in order to achieve the program objectives. It was determined that Alliancing had the potential to achieve greater economies of scale, better value for money, and grab the attention of innovative and successful companies who had the ability to partner with smaller local firms capable of integrating and engaging the local community (FaHCSIA, 2009). Initiated in 2007, the SIHIP was based around the principles outlined in the Victorian Governments (2006) 'Project Alliancing Practitioners Guide' and more specifically characterised by the following:

- Collective sharing of project risks;
- No fault/No blame/No dispute between Alliance participants;
- Payment of non-owner participants (NOPs) for their services under a '3-limb' compensation model:
    - *Reimbursement of NOPs project costs on a 100 percent open book basis;*
    - *A fee to cover corporate overheads and normal profit; and*
    - *A gainshare/painshare regime where the rewards for good performance and the penalties for poor performance are shared equitably.*
- Unanimous principle based decision making on all key project issues;
- Integrated project team selection based on best person for each position; and

- Early involvement of contractors.

Specific details of the SIHIP Project Alliance are summarised in Table 1.

Table 1: The Structure of the SIHIP Project Alliance

PROCUREMENT SYSTEM	Alliance Contract System: Separated into 3 regional project alliance partners assigned work packages in separate geographical regions. Engaged to collaboratively manage the delivery, design, construction, refurbishment and management/maintenance of the project
GOVERNANCE	*NT State Government:* Contracting entity, responsible for the delivery of the program, management of contracts, organisation of land tenure, capital works and development planning. *Australian Federal Government:* Strategic guidance and management of the program and contracts; development and support during procurement process and program establishment.
ALLIANCE STUCTURE	Governed by the agreement between the federal and NT governments the alliances consist of a combination of the following: • Head Contractor; Developer; Local Construction Firm; Engineering firm; Civil Contractor; Specialist Trade Contractor; Building services company; and Suppliers
ALLIANCE DELIVERABLES	The alliance method led the Australian and NT Governments to select and engage professional services including: • Program management services; Cost management; Design coordination; Construction management; Financial Audit services; Value for money
TIME FRAME	Completed by the end of 2013
DELIVERABLES	New Houses = 750; Rebuilt Houses = 250; and Refurbished Houses = 2500
METHOD	Phase 1- *Selection of alliance partners* Phase 2- *Planning and Development* Phase 3 - *Delivery/Construction*
PARTNERS	*Earth Connect Alliance:* • Canstruct Pty Ltd; WorleyParsons Pty Ltd; Force 10 International Pty Ltd; Greene & Associates Pty Ltd; and Ostwald Bros. Pty Ltd *New Future Alliance*: • Leighton Pty Ltd; Broad Construction Services Pty Ltd; Opus Pty Ltd; and Ngarda Civil & Mining Pty Ltd *Territory Alliance Partners*: • Sitzler Pty Ltd; Laing O'Rourke Australia Construction Pty Ltd; McMahon Services Australia Pty Ltd With a Sub Alliance Participant: • Compass Group (Australia) Pty Ltd
INITIAL BUDGET	Australian Government: $ 547 Million NT Government: $ 100 Million Additional: $ 25 Million Total = $672 Million
ESTIMATED UNIT COST (from cost planning process)	New House Target Cost: $350,000 Estimated Regional Package Cost: $30-$50 million

5.3 Principles for Success

The procurement system must successfully address the issues present through the delivery of a housing project that achieve sustainable housing and associated outcomes (Tipple and Willis, 1991). Identifying the primary issues associated with remote IH is the first step in developing the project objectives and subsequent desired outcomes for the SIHIP. Through thematic and statistical analysis of literature, government surveys

and statistical reports, a number of themes were established as key principles for success in the procurement of IH. These principles affect the success of remote housing programs and are critical issues that can assist in improving the outcomes of remote IH in the NT. These 11 principles are listed below, however, due to the word limit constraints of this paper, only the first two (2) are reported in detail here. The other nine (9) principles are discussed elsewhere (see Jefferies et al 2011; Jefferies et al, 2012). The 11 principles for success in the SIHIP Project Alliance are:

1. Sustainable Practices; 2. Effective Program Management; 3. Adaptability; 4. Community Involvement and Consultation; 5. Regional Focus; 6. Value for Money; 7. Cultural and Social considerations; 8. Design Suitability; 9. Economic Development; 10. Construction Standards; and 11. Time.

The following discussion of 2 of the key principles for success draws upon the outcomes of 'The Review' (FaHCSIA, 2009) and the 'Post Review Assessment' (PRA), (Donald and Canty-Waldron, 2010).

5.3.1 Sustainable Practices

For the SIHIP to successfully achieve its objectives the outcomes must be sustainable. In turn the Program must foster growth and future development to ensure that the work completed benefits the current population while improving outcomes for future generations (Walker et al, 2003). The Project Alliance framework has enabled engagement of local suppliers and firms to assist in the delivery of the SIHIP. Through economic development this stimulates economies for sustainable employment and stabilises local economies. The engagement of local suppliers and producers can contribute to environmental sustainably if arrangements such as that of the similar Hopevale project are in place, where the housing designs were based on a locally grown and manufactured bamboo floor and wall panelling product (FaHCSIA, 2007). Even so, the use of local suppliers still assists the sustainability of these suppliers as costs and transport emissions are reduced by smaller distances for importing materials/resources.

The PRA concludes that the collaboration between government and alliance partners is directly attributed to the program achieving sustainable outcomes as well as broader social and economic benefits (Donald and Canty-Waldron, 2010). In addition the integration of maintenance and asset management practices into the delivery process can affect the long-term sustainability of the project outcomes. Through incorporating maintenance schedules and asset management principles in the early stages of the project, management of the dwellings during occupation can be improved. The involvement of local resources also contributes to this factor, as the training of local workers enables an understanding of buildings and their associated maintenance needs, to ensure that the buildings are not only maintained to the standards that they were built, but the occupant and users will hold them in higher value due to their involvement in the construction, design and maintenance processes.

The PRA states that the "failure of past procurement models in delivering sustainable outcomes in remote areas indicates that Alliancing and other non-traditional procurement methods are far more suited to implementing sustainable practices and achieving outcomes" (Donald and Canty-Waldron, 2010). Issues that arose with the

management structure of the program led to unbalanced elements of consultation, quality, time and cost. This lead to the initial packages of work to be declared unsustainable, and would not achieve the objectives across the entire project (FaHCSIA, 2009). Although some aspects of the management and implementation processes of the Alliance model require revision, this is due primarily to the fact that this is a somewhat untested procurement method for the delivery of IH. Overall the SIHIP alliance framework utilises sustainable practices to a moderate level.

5.3.2 Effective Program Management

A key function in the management and governance of the SIHIP was the development of relationships, collaboration and the integration of the program. The nature of the Alliance framework enabled a strong relationship to develop between all stakeholders from a very early stage with collaboration then encouraged and the integration of many of the Program's functions. Evidence of this lies in the Post Review Assessment where the efforts of the Program Managers to utilise the potential of the Alliance system. In particular, developing an 'open-book' approach by providing the Alliance partners with policy agreements on objectives, targeted costs and outcomes developed by the State and Federal Governments which removed the ambiguity of costs and scope of works for the project. This enables increased overall performance in the delivery of the housing outputs (Donald and Canty-Waldron, 2010).

During the review it was found that program management and administration costs were too great, running at 11.4% of the total budget for the program. This was understood to be resulting from inefficient management structure, a high level of external contractors in regular government management positions and an over complex Post-Development Report (PDR) process. With the SIHIP being a pioneering use of the Project alliance system in the NT, and indeed for large scale housing programs, these issues can be contributed to the inexperience of all participants including the NT and Australian governments. As the development of the management structure and processes were based on very little precedents, and the initial stages of the alliance development was resource intensive, in turn this became cost intensive.

Following the review, the governance structure was streamlined and revisions were made to the PDR process, and several outsourced (contractor) positions in government were subsequently filled with government employees. This had the effect of reducing the Program management and administration costs to under 8% (Donald and Canty-Waldron 2010). The review also identified that despite the immediate achievement in program costs and management organisation, more focused, and greater resourcing would be needed, particularly in communities to effectively support the overseeing and management of the project works. Overall the effect of the Alliancing system on program management is positive, although the inexperience of both government and NOPs, and for efficient management of a program of this scale some revision is needed as it can often only be discovered through trial and error. At this stage, the level of which the Alliance model addresses the efficiency of program management is somewhat minor but with promising improvements.

6 Conclusions

Housing conditions for indigenous Australians in remote parts of the Northern Territory are well below the standards of the rest of the country's population. Overcrowding, poor living conditions and even homelessness have not been solved by previous programs. Delivery methods for remote Indigenous housing are in need of reform to address the problems and disadvantage of these communities. Successful housing outcomes are driven by the holistic procurement of design, construction, management and maintenance services. Using a case study analysis of the SIHIP Project Alliance, 11 principle success factors were identified as being critical for this project. This paper identified these 11 principles, but due to word limit constraints of the paper, only 2 of them are reported in detail. The 2 reported principles being 'sustainable practices' and 'effective program management'.

The SIHIP is the largest scale program of its kind in Australia and is improving the outcomes of remote Indigenous housing. Project Alliancing is providing a shift from traditional contracting methods and subsequently offering a range of benefits to improve IH. The SIHIP Alliance framework was found to encourage collaboration, embrace innovation and allowed all participants to work as an integrated team towards reaching the project objectives. Repeatedly defined as being suited to complex and dynamic projects that have an undefined scope of works, Alliancing is as an appropriate procurement method to be applied to the ever-changing problem of remote IH delivery. Project Alliancing is a pioneering procurement method and the SIHIP is the first time this approach has been applied to a Capital Works program in Australia's NT. Through greater experience and further commitment with relational contracting methods, Alliancing will be at the forefront of project delivery of IH programs for remote Australians and ultimately should help to close the disadvantage gap.

The findings reported in this paper warrant further research into the procurement of remote IH. SIHIP has shown that Project Alliancing has the potential to improve the outcomes of similar challenging projects and has the ability to change the way in which other large-scale Public Sector projects are procured. The following areas are recommended for further research in order to improve IH procurement:

- Conduct further analysis of SIHIP outcomes on project completion in 2013;
- Assess the impact of policy and legislation on procurement methods for IH; and
- Develop relational contract conditions for standard Australian construction contracts such as AS2124 and GC21.

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Rethinking Regulation of the Home: Legal Rights and Policy Choices

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Abstract:
The prevailing tendency within English law is to regulate the home differently according to whether the occupier is a renter or owner. However, by taking tenure classification as a starting point current regulation focuses too heavily on form. A functional, substance-based approach should be adopted, that begins from the common feature that the property is a home. Differences in regulation are acceptable provided that they are objectively justified rather than being based simply on tenure classification. The terms 'owner' and 'renter' imply homogeneity within each of these tenures but they are misleading and obscure significant differences. Consistent policies have helped to make owner-occupation the normal tenure, at the expense of the rental sectors, yet the home as a distinct entity is largely unrecognised by the law governing owner-occupiers. The legal structure of Low Cost Home Ownership schemes helps to reveal the fundamental weaknesses of using tenure categorisations as a starting point for regulation.

Keywords:
Home, owner, regulation, renter, tenure.

1 Introduction

The prevailing tendency within English law is to regulate the home differently according to whether the occupier is a renter or owner. The primary purpose of this paper is to show the inadequacy of tenure classification as the basis of legal regulation. Our thesis is that by taking tenure classification as a starting point current regulation focuses too heavily on form. We argue that a functional, substance-based approach should be taken, that begins from the common feature that the property is a home, irrespective of the tenure under which it is occupied. We do not suggest that all homes should necessarily be regulated in the same way, but that differences must be objectively justified, rather than being based simply on tenure classification. This rebalancing is of central importance since tenure classification determines occupiers' legal rights and can lead to significantly different consequences depending on the way in which the person's occupation is classified. Our starting point is two-fold: first, Lorna Fox's ground-breaking work which demonstrated the existence of a particular concept of home (Fox 2007); and secondly Britain's obligations under the European

Convention on Human Rights which have brought an increasingly consistent jurisprudence from the European Court of Human Rights that adopts an autonomous meaning of home under Article 8 that is not restricted to traditionally defined legal rights.[2]

Criticism of tenure analysis is not new, but our contribution is to examine tenure through the lens of property law. By using this approach to deconstruct the categories of owner and renter, we highlight the lack of homogeneity within tenures both in terms of the legal rights of each as well as the characteristics of those who live there. We demonstrate that the differences between owning and renting are not inherent, as is sometimes suggested, but reflect policy choices. We identify a consistency in policy that has seen the acceptance of owner-occupation as the normal tenure and the association of ownership with specific benefits that need not, in fact, be confined to this category. The emphasis on owner-occupation is important because it has come at the expense of renting. Successive government policies have reduced the rights of renters, whether in the private or social sectors, and so reinforced the desirability of owner-occupation. These choices provide the foundation of an ideology of home ownership in which the status of homeowner becomes a social ideal (Ronald 2008: 2).

Our analysis is timely as the ideology of home ownership is starting to be questioned. Owner-occupation in its traditional form is increasingly unavailable to large sections of the British population – initially as a result of rising house prices (which remain unaffordable to many despite more recent falls) but now additionally through more conservative lending practices following the global financial crisis. Consequently, more imaginative housing solutions have been sought, particularly through Low Cost Home Ownership (LCHO) schemes that have been used to fill the affordability gap between government ambition and the personal desire for home ownership on the one hand and the ability of purchasers to buy a home using commercially available finance on the other. A commonly used legal model for the delivery of LCHO is shared ownership, known as part-buy, part-rent. As its name suggests, it leaves purchasers with a foot in each of the tenures, a situation reflected in the legal rights and responsibilities of purchasers (Bright and Hopkins 2011). As such, the traditional divides affecting the regulation of homes is being increasingly blurred. There is also a growing awareness of the risks of home ownership and of the undesirability of having one's financial security tied-up in a single asset (Fennell 2008, Smith, Searle & Cooke 2009, Heywood 2011). As a consequence of both these factors, the trajectory is no longer one way and there are early signs of a move to a post home-ownership era. As the focus shifts away from traditional home ownership, the function of the property as a home will become even more significant.

2 Tenure Trends

To provide background to our discussion of tenures, we first consider tenure trends within Britain. The purpose is not to attempt a full description, which is well documented, but to highlight the role that policy choices have played in the tenure trajectory and to place that trajectory in a comparative context. During the course of the 20th century, Britain changed from a nation of private renters to 'a nation of home-

[2] *Gillow v UK* (1986) 11 EHRR 335; *Buckley v UK* (1996) 23 EHRR 101.

owners' (Saunders 1990). The 20th century also saw the development of the public rented sector which at its peak housed a third of the population. Since then, because of homes lost through the Right to Buy (RTB) and lack of reinvestment, the public rental sector has become increasingly residualised (a characteristic it has arguably always had) (King 2010).

Owner-occupation in Britain was on an upwards trajectory from the early part of the 20th century and reached a peak of 70% at the turn of the 21st century. Since then, the global financial crisis has seen an unprecedented dip and the trajectory has been downwards since 2007. It now stands at around 68% (Department for Communities and Local Government, Live Statistical Tables). This level of home ownership is not unusual in developed countries and similar rates are found in the USA and Australia (US Census Bureau 2011, Australian Bureau of Statistics). A more diverse pattern emerges throughout Europe. In Germany, home ownership has remained below 45%. Voigtlander attributes this to a number of factors, including strengths in the private and social rented markets and the existence of a genuine choice (Voigtlander 2009). In contrast, in some Eastern European countries the sale of State-owned housing following the collapse of socialism has seen home ownership rise above 90% (European Mortgage Federation 2011).

Thus at the present time, and since the early-to-mid 1980s, owner-occupation is seen as the 'normal' tenure. The privately rented sector (PRS), a tenure for all at the start of the 20th century, is now seen principally as a sector for short term occupation for the young and upwardly mobile (Rugg and Rhodes 2008). The classic view of the PRS tenant is someone who is not yet ready to enter owner-occupation. The social sector, comprising public sector landlords and Registered Providers (bodies with a hybrid public-private status), acts principally as a safety net for the poor and vulnerable. Until a recent policy development, discussed below, it has offered a permanent housing solution for those who will probably never be in a position to be owner-occupiers. Those who can move out of the sector into home ownership have been encouraged to do so through discounts and grants.

The trajectory of tenure has not been exclusively driven by policy choices. There has never been any 'grand plan' in terms of the ideal composition of the housing market and it is undoubtedly the case that changes have occurred as a result of factors that were unplanned or unintended. Notwithstanding, it is equally apparent that policy choices have been made which have intentionally impacted on tenure. Housing tenure became politicised from the 1950s. This was after the first significant expansion of home ownership had taken place, but before a second expansion that was led by the Conservative administrations of the 1950s and early 1960s. By the end of the 1970s it was apparent that owner-occupation had reached saturation level in terms of the ability of people to move from the PRS to owner-occupation through their own resources. Any further expansion would therefore come at the expense of the public rented sector. This was embraced by the Conservative government's manifesto (under Prime Minister Margaret Thatcher) commitment to the RTB. Despite the Labour Opposition's hostility to this policy, it was maintained by Labour when in government between 1997 and 2010, and the current British Conservative-Liberal Democrat coalition government has recently reinvigorated it by increasing the maximum discount that can be accrued. Equally, the short term nature of the PRS

tenancy has been maintained under governments of both political complexions. As such, owner-occupation as the normal tenure has now become accepted by all the major political parties.

3 Property Relationships And Policy Choices

Against the background of tenure trends, we turn to consider the heterogeneity that exists within each tenure which reinforces our contention that tenure classification is an inappropriate starting point for regulation. We also show that the differences between the tenures are not inherent but reflect policy choices. What we find is a re-enforcement between the promotion of home ownership as the tenure of choice and the construction of the tenures so that specific benefits come to be seen as associated with home ownership.

3.1 What is an owner?

Home ownership is generally associated with a range of financial and non-financial benefits. The extent to which they can be enjoyed only by homeowners has proved contentious and Saunders' (Saunders 1990) claim that owners experience the home differently has been significantly doubted, including Fox's work (Fox 2007). Nevertheless, the *Public Attitudes to Housing in England* report (Wallace 2010) shows that the large majority of people in England would choose to buy rather than rent. The advantages of owning rather than renting are identified as being that: (a) it is a good investment; (b) it is more secure in the long-term; and (c) it gives the occupier freedom to do what they want with the property.

The heterogeneous nature of the tenure, and the ability to access these benefits, can be illustrated by three examples. First, the problematic position of long leaseholders as owners has been established by Cole and Robinson's work which aptly summarises their position through the description "owners yet tenants" (Cole and Robinson 2000). Secondly, the category draws no distinction between those who own their home outright and those purchasing through mortgage finance. But for the purchaser the benefits of ownership are dependent on the continuing ability to pay the mortgage. The purchaser also has an enduring relationship with the mortgagee, which by section 87 of the Law of Property Act 1925 is placed on the same footing as that between a long leaseholder and their landlord. Thirdly, Bright and Hopkins have highlighted the different nature of home ownership arising under English LCHO schemes, where both the financial and non-financial benefits obtained may fall short of those associated with 'traditional' home ownership (Bright and Hopkins 2011 and 2012).

3.2 What is a renter?

In Britain, the term renter encompasses those who rent from a private sector landlord, a public authority landlord and a Registered Provider landlord. The tripartite distinction between these three categories is reflected in official statistics. However, even within these sub-categories not all renters have the same legal rights in relation to their home. The category of renter includes both those with property rights (a lease) and those with personal or contractual rights to occupy. Renters do share a number of common features: (a) the legal interest through which they occupy their home is carved out of a superior, freehold interest; (b) they all have a direct

relationship with a landlord; (c) they each pay a regular rent that represents the entirety of the cost for the home, so distinguishing them from long leaseholders. Hence, renters have no "investment" interest in their home; they pay to 'use' the property while the investment interest remains with the landlord; and (d) they each derive their security of tenure and other rights partly from contract and partly from a statutory scheme.

Despite these common features there are significant points of disparity. Each is governed by a separate statutory scheme and there is a huge variation in security of tenure (and other rights) within those schemes. Some tenants are able to buy the property in which they are living through the RTB (or for tenants of Registered Providers, the Right to Acquire). The status of the landlord is different. This feature is particularly significant when human rights issues are at stake since only public authorities and sometimes Registered Providers[3] are subject to the Act.[4] There is also huge variation in the characteristics of those who rent – from students and young, mobile professionals, to families with children, the homeless and asylum seekers. Even within rental sub-sectors, there is great heterogeneity (Rugg and Rhodes 2008).

3.3 Heterogeneity vs homogeneity within the traditional tenure classifications

The heterogeneity within tenures arises because the categories of owner and renter are political constructs, not legal ones. As we explain further below, consistent government policy has sought to emphasise clear lines of demarcation between owning and renting. This dichotomy is reflected in the starting point for regulation of each. Owners come within the auspices of property law, while renters are regarded as being within the purview of housing law. This is not merely a semantic difference but reflects fundamental distinctions concerning the way in which the home is perceived. For housing law, the concept of home is uncontroversial; a primary requirement of the current statutory schemes that regulate the residential landlord-tenant relationship is for the occupier to occupy the dwelling-house as their "only or principal home".[5] By contrast, in property law housing tenures cannot be directly defined by the legal relationship between people and their homes. Here, the focus is the relationship between a person and the "land" on which the home is a fixture or constituent part. What is owned is an "estate" over the land; a bundle of rights enjoyed either forever (as a freehold) or for a lesser period of time as a lease. Importantly, there is no inherent difference in the rights of ownership that can be enjoyed over a freehold or leasehold estate; the difference relates only to the duration for which ownership will be enjoyed. As such, the heterogeneity within the tenures has been obscured by the divisions between owning and renting that have developed from these different starting points.

3.4 Policy and tenure

Housing literature reveals differences of opinion as to whether there are specific characteristics inherent within each of the tenures. Ruonavaara distinguishes between "essentialist" and "constructivist" approaches to tenure classifications (Ruonavaara 1993). The essentialist approach treats housing tenures as "fixed entities with certain

[3] *R (Weaver) v London and Quadrant Housing Trust* [2009] EWCA Civ 235, [2010] 1 WLR 363.
[4] Human Rights Act 1998, s 6.
[5] Housing Act 1985, s 81; Housing Act 1988, s 1(1)(b).

advantages and disadvantages from the point of view of the consumer" (Ruonavaara 1993: 6). This contrasts with the constructivist view that "housing tenures have no natural properties but rather their properties are historically and socially constructed" (Ruonavaara 1993: 6). Ruonavaara argues in favour of an approach that he terms "moderate constructivism". This approach distinguishes between "necessary properties" of housing tenures that are "associated with a certain type of tenure ... by definition" and "contingent properties" that can vary within the limits of the necessary properties (Ruonavaara 1993: 11). Our contention is that an attempt to identify such characteristics is misplaced. From a legal analysis there are some inherent differences between a freehold and a lease, but these are confined to the existence of a relationship of landlord and tenant, not its content. The rights associated with owners and renters are not inherent but are policy choices layered on top of the inherent legal characteristics.

There are a number of examples that could be used to illustrate this point, but for the sake of brevity we refer to just one, the right of disposal. Saunders argued that the right of disposal is essential to ownership and, in his terms, "can never be extended to tenants, simply because the house is not theirs to give" (Saunders 1990: 100). As a matter of law, however, there is no inherent reason why the holder of any property right should not be able to dispose of that right. Hence, for example, there is nothing inherent in the legal estate (the lease) given to a public sector tenant that explains the absence of a right of disposal. The absence of such a right is of course readily explicable, but as a policy choice of ensuring that publicly provided housing is distributed in accordance with an allocations policy. Saunders notes the limited rights of succession that have been conferred on public sector tenants, which he dismisses as falling "a long way short" of a general right of disposal (Saunders 1990: 100). But the existence of such rights represents a further policy layer, that the absence of rights of disposal should, in some circumstances, give way to other objectives. Conversely, not all owners enjoy the same rights of disposal. In particular, disposal has sometimes been limited or restricted in LCHO schemes. This has been done, again, through a policy choice that the individuals' right to dispose should give way to other objectives, such as keeping the unit within the LCHO sector and providing mixed, sustainable communities (Bright and Hopkins 2012).

Equally, there is no reason why the principal advantages of owning identified in the *Public Attitudes to Housing in England* report (Wallace 2010) – investment, long-term security and freedom to do what you want with the property – should be enjoyed by owners and denied to renters. For example, we can see by reference to the way in which the PRS was regulated until 1988 (under the Rent Acts) that it is possible to give tenants significant security of tenure and the ability to pass the property to future generations through the rules on succession; both features that are more commonly associated with owner-occupiers. The relative lack of security of tenure that tenants in the PRS today experience is the direct result of the Housing Act 1988 which sought to deregulate the PRS. Equally, the RTB demonstrates that it is possible for a tenant to invest in their property. The scheme gives public sector tenants the right to buy their existing home at a discount that is based on the number of years that the tenant has been paying rent to the public authority landlord. Thus, while it may not have been the tenant's intention from the outset of the tenancy to buy their rented home, nevertheless, the rent paid effectively acts as an investment in a later purchase.

Conversely, the investment, security and freedom associated with traditional owner-occupation are all limited in LCHO schemes (Bright and Hopkins 2012). The point of importance is that all these features represent policy choices.

We have demonstrated that owner-occupation has come to be seen as the normal tenure, yet in this sector 'home' is a political rather than a legal construct. As Fox has shown (Fox 2007), even where the law acknowledges the home value of the property, there is a strongly pro-creditor bias in disputes involving home owners and lenders. By contrast, the regulation of the rental sectors acknowledges the home as a distinct entity but recent policies have moved in the direction of removing renters' security of tenure, thereby increasingly making owner-occupation the only way of securing long-term housing. However, without a fundamental rethink of the starting point for legal regulation, the significance of the property as a home will remain obscured. The change to a functional-based approach is even more important in light of the development of LCHO schemes which, as we have explained, combine features of both owning and renting.

3.5 An emerging distinction: the 'social' and the 'market'

Having established the inadequacy of tenures, in the final part of the paper we consider a different distinction – that between social and private (or market) based housing. This distinction is commonly drawn in relation to the rented sector. It is less frequently discussed in relation to ownership, but it is undoubtedly present and is becoming more visible having received statutory recognition and definition.[6] As a result, we see the emergence of a distinction between social and market housing that crosses the tenure divide.

The question of what is "social" about social housing is a contentious one (Cowan and McDermont 2006), but there are significant features shared by social housing, whether rented or owned. First, social housing is a site for social policy. The involvement of the state enables housing to be used for objectives other than the provision of a roof over the head. In the rented sector, in particular, this has negative connotations and social housing is seen as a site for social control (Cowan and McDermont 2006). In the owner-occupation sector the connotations may be more positive and state involvement has been used, for example, to build mixed sustainable communities. Secondly, access is governed by eligibility criteria principally according to need, although the nature of the need may be defined differently as between renting and owning. Thirdly, costs are below market level. Hence, rent in social rented housing is below market level. Equally, the rent payable by a shared owner for the "part rented" is set at an "affordable" level.

Thus, for regulatory purposes, the distinction between market and social housing (whether owned or rented) may now be a more relevant one than that between owners and renters. In particular, the broader social policy objectives that social housing seeks to achieve provide an objective point of departure from market housing that may legitimately be reflected in the regulatory regime. As Elias LJ commented in *R (Weaver) v London and Quadrant Housing Trust* "[t]he provision of social housing as opposed to the provision of housing itself is in my opinion a function which can

[6] Housing and Regeneration Act 2008, s 68.

properly be described as governmental. Almost by definition it is the antithesis of a private commercial activity."[7]

Nevertheless, we do not suggest that this distinction, any more than tenure classification, should provide a starting point for regulation. The existence of a clear dichotomy between social and market housing would be disputed. Furthermore, whereas both market and social owners and social renters currently all enjoy significant security of tenure (subject to certain qualifications), as we have seen market tenants have only limited rights. This disparity is the result of policy choices that reflect successive governments' views that the appropriate role for the PRS is as an essentially transitory form of housing. In any event, any distinction is blurred; for example, LCHO schemes that cross the divide between owner and renter also combine features of social and market housing. Equally, recent developments in the social rented sector may be seen to blur the divide between market and social rented housing. A new form of social tenancy – the flexible tenancy – has been created.[8] Whereas social tenancies have traditionally been viewed as offering a home for life, the flexible tenancy is for a fixed period. This feature allows public sector landlords periodically to review the tenant's continuing need for housing and, as such, reinforces the social policy objective that this form of housing is reserved for those in greatest need (Department for Communities and Local Government 2010). Yet it can also be seen to reduce the distinction between market and social rented housing, a key feature of which is the stark difference in security of tenure. Viewed in this light, it may be argued that the policy encourages would-be social tenants to regard the PRS as an acceptable alternative.

In summary, while the market / social division is superficially attractive, it remains highly problematic. We see the lack of a dichotomy, or the blurring of the distinction, as reinforcing our broader thesis that the functional use of a property as a home should provide the starting point for regulation. Nevertheless, the market / social distinction may be a useful tool in informing principles of regulation.

4 CONCLUSIONS

We have shown that tenure is inadequate to provide the basis of legal regulation of the home. The predominance of owner-occupation in Britain is not unique, nor was it inevitable. Its causes are multiple and complex, but policy choices have been made which have seen owner-occupation develop first at the expense of the PRS and then at the expense of the social rented sector. We have also seen that the content of the tenures has been constructed to reinforce the policy of promoting home ownership. These choices provide the foundation of an ideology of home ownership in which being an owner comes to be seen not merely as a means to an end but as an end itself. Yet the home value for owners remains obscured because of the starting point of its regulation. By contrast, the rental sectors recognise the concept of the home but policy developments have reduced renters' security of tenure; first in the PRS and more recently in the social sector. Schemes to fill the affordability gap in owner-occupation combine features of owning and renting, further blurring the traditional

[7] *Weaver* (n3) [70].
[8] Localism Act 2011, s 154.

categories. Collectively, these developments strengthen our argument that it is necessary to rethink the starting point for regulation, based on the common feature that the property is a home.

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AN ASSESSMENT OF THE IMPACT OF FOREIGN DIRECT INVESTMENT (FDI) ON CONSTRUCTION SECTOR OUTPUT (CNS) AND GROSS DOMESTIC PRODUCT (GDP) IN EASTERN AFRICA

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ABSTRACT

Following the debt crises of the early 1980s, the economic paradigm of most developing countries took a complete turnaround with the adoption of outward looking economic policy. Thus foreign trade and investment became integral part of the new economic development strategy. The study investigates the impact of the Foreign Direct Investment (FDI) on Construction Sector Output (CNS) and Gross Domestic Product (GDP) in five Eastern African countries. The study is based on a 40 year annualized time series data (1970-2009) extracted from the United Nations Conference on Trade and Development Statistics (UNCTADStat). The study employs econometric methodology specifically the Vector Error Correction Model (VECM) and Panel Regression Model. The result indicates that FDI significantly impacted on both the CNS and GDP. The study recommends improving investment climate to facilitate increase FDI inflow to support sustained growth of the construction sector and GDP in the region.

Keywords: Construction Sector, Eastern Africa, Econometric methodology, Foreign Direct Investment, Gross Domestic Product.

INTRODUCTION

Many decades of economic stagnation have turned Africa into the world's poorest region (Sachs et al 2004 & Collier 2006). With a gross national income of less than USD765 per person per year, the average African lives on less than USD1 a day in 2008. This is exacerbated by disease, famine and conflicts (Asiedu 2004, IST-Africa 2009). The continent is faced with depreciating local currencies, declining investment, trade, remittances and rising interest rates, input costs and unemployment. This means reduced income for development and risking a further increase in the number of people living under the poverty line (UNDP, 2009). One of the critical causes of Africa's economic woes is inadequate infrastructure (World Bank, 1994). Africa

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ranks consistently at the bottom of all developing regions in terms of infrastructure investment (Calderón and Servén 2008). The poor state of infrastructure in Africa cuts national economic growth by two percentage points every year and reduces productivity by as much as 40 percent (Foster and Briceño-Garmendia 2010). Africa must therefore massively develop its infrastructure to fast track its economy, reduce poverty and catch up with rest of the world (World Bank 2006 & Calderón and Servén 2008).

To close the infrastructure gap with the rest of the world, hundreds of billions of dollars will be required (Briceño-Garmendia Smits and Foster 2008). Considering the wide savings-investment gap in Africa, financing the massive infrastructure deficit will require International Capital Flows (ICF) (Foster and Briceño-Garmendia 2010). ICF helps developing countries to bridge savings-investment gap, eliminate foreign exchange shortages, deepens local financial markets, cushion shocks and promote sustained growth / development and integration into the global economy (UN, 2001 2007, Ernst & Young, 2011). Given the deleterious effect of ICF like debt/Loans in the past, only Foreign Direct Investment (FDI) flows can truly benefit African infrastructure development (Ngowi, 2001). FDI has become one of the most potent sources of capital formation across the globe. The experience of the Asian countries (for example China) indicates that FDI is critical to achieving the growth rates Africa needs to build modern physical infrastructure (ADB 2004 & UNCTAD 2001). Hence greater importance is now being placed on FDI by African countries (ECOSOC, 2000). With the rapid expansion of FDI in the global economy, the effect of FDI on the host economy, particularly the construction sector has lately been contentious. Empirical studies on the effect of FDI on developing economies have generated mixed results (Adams 2009). The mixed findings reached by studies on the role of FDI on growth suggest further investigation.

LITERATURE REVIEW

Until the mid-1980s, most developing countries viewed FDI as a modern form of economic colonialism and exploitation. Consequently, most developing countries regulated and restricted FDI flow (McCulloch 1991). However, the debt crises of the 1980s, pressure from International Financial Institutions (IFIs) and evidence from developing countries that have embraced FDI forced many developing countries to reform their economies policies to attract FDI (ADB, 2004). Some FDI policies pursued by African countries include investment treaties and promotion, trade and exchange rate liberalization, privatization and tax holidays etc (APF 2007 UN 2007 UNCTAD 2007). These efforts appear to be yielding positive result as investors from emerging economies – China, India, Malaysia and South Korea – are now positive about Africa's attractiveness. FDI into the continent is forecast to reach USD150 billion by 2015 from USD84 billion in 2010, driven by strong growth in new projects (APF 2007 & Ernst & Young 2011).

The construction sector is by far the single largest contributor to infrastructure or Domestic Fixed Capital (DFC) in developing countries. Over 50percent of DFC is related to the output of the construction sector (Hillebrandt 2000). Thus adequate constructed infrastructure facilities will solve Africa infrastructure challenges by more than 50percent. However, the Eastern Africa Construction Sector (EACS) is largely underdeveloped and beset by a number of challenges reflecting largely the level of development of the region (Msita 1998 Rwelamila 1996 Lema and Price 1998 Kivaa

1999 and Ministry of Works 2003). Additionally, factors include heavy dependence on government expenditure, competition from Chinese construction companies and the high cost of borrowing (Frost & Sullivan 2010). The challenges facing EACS strongly suggest the need for major transformation to attract FDI (Rwelamila 2006). Fortunately, Governments' focus on infrastructure development to eliminate urban slums, rising consumer demand, the need for new infrastructure and high economic growth in the region are driving growth of the EACS. Institutional reforms to promote the development of the EACS are also being implemented in the region (Eyisi, 2011, Structural Engineer 2011). Furthermore, future growth is predicated on projected high economic growths and the implementation of best practises by utilising high quality construction material (Frost & Sullivan 2010).

The 19 territories that constitute Eastern Africa in the United Nations scheme of geographic regions are: Burundi, Kenya, Rwanda, Tanzania and Uganda (members of the East African Community (EAC)). Others are Djibouti, Ethiopia, Eritrea and Somalia (collectively known as the Horn of Africa) Mozambique, Madagascar, Malawi, Zambia and Zimbabwe (often considered part of Southern Africa). The remaining are small Indian Ocean island nations of Comoros, Mauritius, Seychelles and French overseas territories -Réunion and Mayotte (Stock 2004). Eastern African countries are undergoing political and economic reforms to facilitate fast growth. The EAC integration with a combined GDP of US184 billion in 2010 is expected to give greater economic clout to the region, bringing tremendous benefit to member countries, particularly the smaller ones. The EAC is in a tri-partite agreement with the Common Market of Eastern and Southern Africa (COMESA) and the Southern Africa Development Community (SADC) to establish a Free Trade Area (FTA) of 26 African countries in North, South and East Africa. This gives the EAC exposure to a market of at least 500million people and a combined GDP of about US700 billion. Potential sources of instability in the region include the conflict in the DR Congo and Somalia (World Bank 2012, Eyisi 2011). The five countries selected for the study are Kenya (KEN), Mauritius (MAU), Mozambique (MOZ), Seychelles (SEY) and Zambia (ZAM).

ECONOMETRIC METHODOLOGY

Econometrics is the application of mathematics and statistical methods to economic data to give empirical content to economic relations (Pesaran, 1987). The study adopted the Vector Error Correction Model (VECM) and Panel Regression Model for the analysis. The VECM model is one of the most successful, flexible and easy to use models for the analysis of multivariate time series. VECM often provides superior forecasts to those from univariate time series models and elaborate theory-based simultaneous equations models. It is also used for structural inference and policy analysis (Hall 1994). According to Engle and Granger (1987) when a set of variables I(1) are cointegrated then short run analysis of the system should incorporate an Error Correction Term (ECT) in order to model the adjustment for the deviation from its long run equilibrium. The VECM is therefore characterised by both differenced and long run equilibrium models thereby allowing for estimates of short run dynamics as well as long equilibrium adjustment process. The panel-based VECM for this study is specified as follows.

$$\Delta LCNS_{it} = \emptyset_1 + \sum_{i=p}^{r} \beta_{11p} \Delta LCNS_{t-p} + \sum_{i=p}^{r} \beta_{12p} \Delta LFDI_{t-p} + \sum_{i=p}^{r} \beta_{13p} \Delta LGDP_{t-p} + \alpha_{11} ECT_{it-1} + \quad (1)$$

$$\Delta LFDI_{it} = \emptyset_1 + \sum_{i=p}^{r} \beta_{21p} \Delta LCNS_{t-p} + \sum_{i=p}^{r} \beta_{22p} \Delta LFDI_{t-p} + \sum_{i=p}^{r} \beta_{23p} \Delta LGDP_{t-p} + \alpha_{21} ECT_{it-1} +$$
(2)

$$\Delta LGDP_{it} = \emptyset_1 + \sum_{i=p}^{r} \beta_{31p} \Delta LCNS_{t-p} + \sum_{i=p}^{r} \beta_{32p} \Delta LFDI_{t-p} + \sum_{i=p}^{r} \beta_{33p} \Delta LGDP_{t-p} + \alpha_{31} ECT_{it-1} +$$
(3)

where $i = 1,\ldots,N$ denotes the country; $t = 1,\ldots,T$ denotes the time period; ε_{it} is assumed to be serially uncorrelated error term; ECT is the lagged error-correction term derived from the long-run cointegrating relationship.

Construction Sector (CNS); this the total market value of all final goods and services produced within the construction sector in a country during the year in USD 2005 price;

Foreign Direct Investment (FDI); is total value of inflow of FDI into a receiving country in USD within the year;

Gross Domestic Product (GDP); refers to the market value of all final goods and services produced within a country in a given within the year.

The data for the study is based on annualised 40 year period from 1970 through 2009 extracted from United Nations Conference on Trade and Development Statistics (UNCTADStat). The VECM procedure however involves modelling the series after unit root/stationarity and cointegration status of the series has been determined.

Panel Unit Root Test

The study employs five methods to perform the panel unit root test - Breitung (2000) t test; Levin, Lin and Chu (2002) t panel unit root test (LLC); Both Breitung and LLC tests assume that there is a common unit root process across the cross-sections. For these tests, the null hypothesis is that there is a unit root, while the alternative hypothesis is that there is no unit root; Im, Pesaran and Shin (2003), W-test (IPS); a Fisher-type test using Augmented Dickey-Fuller (Maddala and Wu, 1999) (ADF-Fisher Chi-Square); and Choi, (2001) and Phillips-Perron (1988) (PP-Fisher Chi-Square test); The IPS, ADF and PP tests assume that there are individual unit root processes across the cross-sections. For these tests, the null hypothesis is that there is a unit root, while the alternative hypothesis is that some cross-sections do not have a unit root.

Panel Cointegration Test

The cointegration tests for this study are performed using three main tests, namely Pedroni (1999), Kao (1999) and Johansen Fisher tests (Maddala and Wu 1999). The Pedroni (1999) cointegration test basically employs seven (four panel statistics and three group panel statistics) statistics to test the null hypothesis of no cointegration against the alternative hypothesis of cointegration. The seven component tests of Pedroni are: the panel v test, panel rho-test, panel PP-test, panel ADF-test, group rho-test, group PP-test and group ADF-test. The Kao (1999) cointegration test follows the same approach as the Pedroni tests, but it specifies cross section specific intercepts and homogeneous coefficients on the first stage regressors. In the null hypothesis, the residuals, are non-stationary (i.e., there is no cointegration). In the alternative hypothesis, the residuals are stationary (i.e., there is a cointegrating relationship among the variables). Maddala and Wu (1999) used Fisher's result to propose a method for combining test from individual cross-sections to obtain a test statistic for the full panel. Two kinds of Johansen-type tests have been developed: the Fisher test

from the trace test and the Fisher test from the maximum Eigen-value test. In the Johansen-type panel cointegration test, the lag order is set as one.

Panel Regression

Panel Regression is a regression which includes both cross sectional and time series data. Panel data may have group effects, time effects, or the both. In practice, the estimation procedure is either the Fixed Effects Model (FEM) or the Random Effects Model (REM) (Greene, 2003). The FEM is used if there are unique attributes of individuals that are not the results of random variation and that do not vary across time. The Fixed group effect model examines group differences in intercepts, assuming the same slopes and constant variance across entities or subjects. The FEM assumes that the slope coefficients are constant for all cross-section units, and the intercept varies over individual cross-section units but does not vary over time (Hsiao, and Hsiao, 2006**).** The study used FEM to analyse the differential performance of the construction sector across the five selected countries.

RESULT

Result of Panel Unit Root tests; the results of unit root test in level show that the series have unit root and are thus non stationary. The test was then rerun in their logarithmic and first difference form. The result then indicates that at 1percent all the series are stationary. All series are therefore taken as nonstationary at level but stationary at first difference I (1). The panel unit root test results are reported in table 1 for the first difference of the data.

Table 1 Panel unit root test result (first difference)

Panel series	**Null: Unit root (common unit root process)**		**Null: Unit root (individual unit root process)**		
	LLC t	Breitung t	IPS	ADF	PP
ΔLCNS	-2.70715***	1.08906	-0.89743	20.6159**	46.9999***
ΔLFDI	-13.4228***	-7.72328***	-13.9022***	282.666***	882.500***
ΔLGDP	-2.30491**	-4.38860***	-5.08350***	43.6991***	71.3419***

*, **, or *** indicates significance at 10, 5, or 1 % respectively

Result of Panel Cointegration; the summary of the Pedroni cointegration test using the assumptions of no deterministic trend indicate that only two of the seven tests statistics are significant. The Kao test suggests no panel cointegration at a 10% level of significance. However, the Johansen Fisher test suggests the existence of one cointegrating vectors at a 1%. Overall, there is statistical evidence in favour of significant panel cointegration among LCNS, LFDI and LGDP in Eastern Africa. The evidence of cointegration rules out the possibility of spurious regression problem. Table 2 shows the panel cointegration tests result.

Table 2 Panel cointegration test result for LCNS, LFDI and LGDP

Pedroni Residual Cointegration Test	**Statistic**	**Prob.**
Panel v-Statistic	-0.074808	0.5298
Panel rho-Statistic	-2.408145	0.0080***
Panel PP-Statistic	-2.801019	0.0025***
Panel ADF-Statistic	0.208210	0.5825
Group rho-Statistic	0.783491	0.7833

Group PP-Statistic	-0.027221	0.4891
Group ADF-Statistic	2.168004	0.9849
Kao Residual Cointegration Test		
ADF	-0.358832	0.3599
Johansen Fisher Panel Cointegration Test,		
Hypothesized No. of CE(s)	Fisher Stat. (from max-eigen test)	Prob.
r=0	31.32	0.0005***
r≤ 1	7.146	0.7116
r≤ 2	6.784	0.7457

*,** or *** indicates significance at 10, 5 or 1% respectively

Cointegration Vector

The cointegrating vector is normalized on LCNS. The model indicates significant positive effect of LFDI on the LCNS, while the LGDP has insignificant negative on the LCNS. For Eastern African unbalanced panel data, the long-run panel elasticity of LCNS with respect to LFDI is below unity (0.658380), indicating that for every 1percent increase in LFDI, LCNS increases 0.66percent. The Result also indicates that a 1percent increase in LGDP decreases LCNS by 0.53percent. The panel cointegration equation can be written as

LCNS= 4.972720 + 0.658380LFDI-0.533219LGDP

Table 3 Cointegrating vector for Eastern Africa

Normalizing on LCNS	**C**	**LCNS**	**LFDI**	**LGDP**
	4.972720		0.658380	-0.533219
Alpha		0.021822	-0.219904	0.004642
Loading factor		[2.20564]	[-2.67172]	[1.22872]

t-statistics in [ ]

The loading factors (coefficients of the ECT) indicate that about 2.18percent, 21.99percent and 0.46percent of disequilibrium in the system is corrected every year by changes in LCNS, LFDI and LGDP respectively. The t statistics of the loading factors for LGDP and LCNS are positive and insignificant. The t-statistics of LFDI is however, negative and significant implying two unidirectional long-run panel causality links running from LFDI to LCNS and LFDI to LGDP (see table 3). The result of the cointegrating vector confirms two significant unidirectional causalities-FDI→CNS and FDI→GDP in Eastern Africa. The FDI →CNS direction is supported by the Endogenous Growth Theorem (EGT) of Barro and Sala-i-Martin (1995) among others, that FDI promotes long run economic growth through permanent knowledge transfer (technology spillover) . The FDI→GDP direction is also supported by the FDI →growth theory (as explained by the EGT). Thus the FDI-led-CNS/GDP growth hypothesis seems applicable for Eastern African countries. Therefore based on these finding, Eastern Africa' policy makers may formulate policy to attract more FDI as means of growing their CNS/GDP.

The Fixed Effects Model

Table 4 presents the estimated results from the FEM regression. The estimate of the intercept of the model is negative and insignificant at 10percent. This means that without the regressors Eastern African countries experiences insignificant de-construction of up to 50.55percent. This also means that the regressors are able to capture most of the factors that affect the Construction Sector output in Eastern Africa

and that there are lower limits (or thresholds) of lagged CNS, FDI and GDP before positive CNS output can take place. The estimate of the country fixed effects show that three countries- KEN, MOZ and SEY have negative effects. This statistically suggests that comparatively these countries have lower CNS output given their respective FDI and GDP with MOZ being the worse. Some of the plausible reason for this below average performance of KEN, MOZ and SEY may not be unconnected to the many episode of oil price shocks (Kenya, Mozambique and Seychelles are net oil importers) political crises (Mozambique) economic recessions, Structural Adjustment Programmes and drought (Kenya, Mozambique and Seychelles) during the period 1970 through 2009 (SAPRIN 2002 and CIA 2012).

Table 4 Result of FEM

Dependent Variable: LCNS	**Cross section Fixed effect Model**		
	Coefficient	t-Statistic	Prob.
C	-0.505589	-0.855100	0.3937
LCNS(-1)	1.238553	14.50051	0.0000
LCNS(-2)	-0.298117	-3.353425	0.0010
LFDI(-1)	0.015505	1.819855	0.0705
LFDI(-2)	-0.002197	-0.265692	0.7908
LGDP(-1)	0.197944	0.838524	0.4029
LGDP(-2)	-0.133095	-0.577704	0.5642
KEN	-0.008760		
MAU	0.018238		
MOZ	-0.022107		
SEY	-0.006073		
ZAM	0.017685		

CONCLUSION

The study finds significant long-run equilibrium relationship among CNS, FDI and GDP. The cointegration vector indicates two significant unidirectional causal effects FDI→CNS and FDI→GDP; that is FDI makes significant causal impact on CNS and GDP. This implies that greater FDI inflow will help accelerate growth in CNS and GDP in East Africa. The study recommends that policy makers in East Africa should improve investment climate to attract greater FDI inflow for sustained growth of the EACS and the economy. The FEM suggest that CNS in KEN, MOZ and SEY performed poorly compared to MAU and ZAM. For the construction lagging countries (i.e. KEN, MOZ and SEY) the study recommend deepening reform for greater FDI inflow and strengthening the capacity of EACS to benefit from FDI inflow to accelerate growth.

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CASE STUDY: THE IMPLEMENTATION OF A PERFORMANCE METRIC SYSTEM IN A CAPTIAL IMPROVEMENT ORGANIZATION.

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ABSTRACT

A capital improvement department of one of the largest universities in North America provides a case study for implementing a performance metric system. The absence of past and ongoing project performance data leaves a capital improvement organization without the essential metrics needed to evaluate the organizations efforts and provide transparency in areas of deficiencies. Collecting project metrics is deemed essential to improving project efficiency with regards to completing projects on schedule and on budget. The project data of numerous ongoing and completed construction projects are captured through the development of a weekly risk report. Partnering vendors are required to capture the performance measurements in the weekly risk report and submit weekly to provide updated project data to the organization. This data is combined to provide a report to the organization executives of overall project status, including in progress projects, and areas in their processes that require additional focus.

Keywords: capital improvement organization, measurement implementation, performance metrics, qualitative metrics, university.

INTRODUCTION

Frederick Taylor, an early twentieth century management expert, stressed the importance of metrics while he developed his popular "scientific management", his theory concluded that deductive reasoning with data collected through experimentation and observation creates greater efficiency within organization processes (Love et al., 1999). Since Frederick's early conclusion, performance metrics have evolved with in many successful organizations and provide the statistical knowledge in which leadership is able to make more informed decisions. Two distinctive categories of measurement are available and when combined create a clear picture in which one can gauge an organizations success: "Quantitative Metrics" focus more specifically with production numbers, cash flow, and statistical numbers, these statistical metrics alone are inadequate representation of a company's performance; "Qualitative Metrics" are the intangible results that capture the

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level of satisfaction with the process and products and they have been found to be equally important in understanding company performances (Kaplan & Norton, 1992; Kagioglou et al, 2001). As the benefits from performance measurements have been recognized in the last century, numerous measurement implementation processes have been created and thousands of papers have been published on the importance of measurements (Bassioni et al, 2004).

One industry that has struggled to implement qualitative gauges within their organizations has been the construction industry (Egan 1998). Construction organizations continue to rely on quantitative measurements alone when accessing their progress, this project specific data or short term data does not allow an organization to gauge the overall level of quality or satisfaction of its long term efforts (Kaigioglou et al, 2001). In 2005, a capital improvement organization in one of the largest universities in North America found itself without performance measurements of the organization's long term goals. This paper provides a case study of an organization's attempt to capture both quantitative and qualitative information to assist their stake holders develop the efficiency of the organizations effort.

Performance Measurement

Performance measurements in the built environment are described as "a quantifiable, simple, and understandable measure that can be used to compare and improve performance" (Pitcher, 2010). Pitt and Tucker (2008) explain the three reasons for measurements as: 1) to ensure the achievement of goals and objectives; 2) to evaluate, control, and improve procedures and processes; and 3) to compare and review the performance of different organizations, teams, and individuals. Metrics have also been found to assist with providing organizations with organized customer ratings, reviews and suggestions (Love & Holt, 2000).

When applied to organizational goals with industry competition, it is closely tied to a benchmark set or initial measurements and used longitudinally to demonstrate progress over time. It can be effectively stated that measurement at the organizational level is "The systematic process of measuring an organization's performance against recognized leaders for the purpose of...superior performance when adapted and utilized" (Pitcher 2010).

Two limitations are often seen with performance metrics: first, metrics are retrospective, with markets frequently changing, continuous performance metrics are necessary for it to be meaningful to the current climate as past data reflects past markets (Halachmi, 2005; Busco et al, 2006); and second, comparable benchmarks are often unavailable to contrast company performance, competitors reluctance to release proprietary information forces organizations to place benchmarks from past metrics or individual goals (Kaplan and Norton, 1992). Both limitations impacted the case study that is presented below and required additional effort from the organization to improve the significance of the metrics.

Current Construction Measurement Environment

The construction industry has many difficult variables when gathering measurements as it usually tends to focus on short term gauges (Love & Holt, 2000). With such a high variance between projects most construction organizations are only able to measure a specific project and unable to compare them to any past or future projects, these typical on-time, on-budget and satisfactory measurements alone are inadequate to gauge a construction company (Chapman et al, 1991). Organizations that are responsible for multiple construction projects have not produced a measurement methodology that can track the quality, social impacts and human factors that are included in qualitative measurements (Love & Skitmore, 1996).

A 2008 extensive review of more than 4,500 articles on performance measurements within construction found the inability of the industry to find common ground with metrics, only 42 articles had actual collected data with a construction organization and out of those 42 only 16 had seen any improvements from performance information (Egbu et al, 2008). Amaratunga and Baldry also recognized the lack of concrete evidence that the concepts of performance measurements are utilized in the build environment (2001). The author's own literature review of numerous research papers found no methodologies that can be used by a construction organization to develop a performance measurement system that can capture multiple project data.

Implementation of Measurements

The planning phase of implementing a metric system within an organization is critical due to the change of environment that will be created within the organization and also the obstacles that will impede a system from succeeding. The employee's environment within an organization will change when introducing measurements, as part of Mayo's (1949) measurement research, it was summarized that worker productivity increased with the psychological stimulus of being shown individual attention, feeling involved, and being made to feel important, and in another section, "Employees are more productive because the employees know they are being studied". Creating a measured environment alone can motivate employees to perform better for a period of time, but for continuous improvement, measurements must be implemented and managed efficiently within the organization (Halachmi, 2005). Implementing metrics is a difficult task, planning can help minimize the impact of six obstacles that are common with creating metric systems: 1) a company's inability to define their operation process; 2) a company's inability to relate their process to acceptable performance; 3) apprehension of misrepresenting performance; 4) apprehension of poor performance; 5) misinterpreting the measurements; 6) and collecting the wrong or unnecessary metrics (Zaire, 1996).

During the initial setup of a metric system critical information must be identified, analyzed, and prioritized for the system, management should also be able to understand how the metrics will be of benefit to the organization. While gathering the most critical metrics in the beginning Kaplan and Norton (1992) suggest asking four questions for focusing on areas that can improve:

1. Financial: how do we look to shareholders?
    - Examples: profits on the project, overall cost of change orders, cost of mistakes, and costs due to delays.

2. Customer: how do customers see us?
   - Examples: client product satisfaction, client satisfaction with cost management, schedule management, close out process, communication, and risk management.
3. Internal Business: What must we excel at?
   - Examples: internal process performance, employee process satisfaction, and safety processes.
4. Innovation and Learning: Can we continue to improve & create value?
   - Examples: recognized areas of improvement, lessons learned, and opportunities for learning.

Love and Skidmore (1996) also present six common characteristics that should receive focus to achieve effective performance measurement systems:

1. develop an organization strategic plan with goals that has been established and agreed upon;
2. include both financial and nonfinancial business measures;
3. understand how benchmarks will be provided for comparative measurements;
4. clearly understand the organizations laws that govern the organizations behavior both within the organization and the industry';
5. present the results of the measurements consistently to develop a established workplace to encourage consistent reactions to the metrics; and
6. have the full support of the leadership and drive the metric system from top to bottom while fostering a sense of belonging and responsibility in the work staff with the results.

CASE STUDY

Capital Planning and Project Management (CPPM) at the University of Minnesota is responsible for all new construction and renovation of existing buildings on the two main universities campuses. The combined staff consists of a director, senior project managers, project managers, and support level staff that are responsible for the procurement of vendors, ensuring their clients receive the desired scope, and assisting the vendors to comply with the codes and requirements at the university.

In 2005, the leadership of CPPM found itself unable to report basic performance metrics which left management second guessing their perceptions of the group's performance. Understanding what impacts caused projects to be delayed or over budget was limited to individual project reports. Managements perception was that projects were being completed thirty percent over budget and thirty percent behind schedule. Without a comprehensive metric system collecting data of all the projects, their perceptions of the reasons for delays and high cost increases were not conclusive and consequentially left management skeptical of contractor's performance. CPPM looked for ways in which they could begin capturing project performance metrics to help minimize overall project impacts. During 2005, CPPM was introduced to a group affiliated with Arizona State University (ASU) that would assist with implementing performance measurements in the construction and renovation of its campus buildings (Sullivan et al, 2007).

University's Implementation of Performance Measurements

Initially, processes for implementing the metrics needed to be defined, CPPM slowly began to test pilot capturing measurements on individual projects. Project processes needed to be defined so that measurements could capture deviations from process in the project, this required additional preplanning before each project. Individual project pre-planning required that the vendors would present the cost and schedule for completing projects, the metrics would capture any changes to the set plan, who or what caused them, and their ability to manage the project impacts not foreseen in the initial plan. The vendors would also be required by the contract to capture these metrics in a report that was submitted to CPPM weekly.

During the first year, while defining the processes that would be used to capture the metrics, CPPM developed a strategic plan to assure that the group would achieve its goals with capturing the performance measurements. The strategic plan set in the beginning was modified over time from the group's experiences and lessons learned to assure that the group was achieving beneficial goals and was minimizing any employees concerns regarding measurements. As CPPM was able to see how they would be able to capture different indicators they were able to effectively refine their metrics. Their metrics would be captured in weekly reports and would be combined into a summarized report to assist management for effective organization management.

Weekly Risk Report

To capture the individual project metrics, CPPM requires that vendor project managers maintain a weekly report that is set up using Microsoft Excel template. This Excel file referred to as the "Weekly Risk Report" (WRR), is set up at the beginning of each project and contains basic project information and the vendors planned schedule and project cost (Sullivan et al, 2006). The vendor manages the WRR and captures any risk to the project that might impact the cost or schedule of the project and the vendors solution to minimize the impact of the risk; each risk is categorized in the WRR to identify who and what caused the issue. The CPPM project manager responsible for the project will rate the vendor's ability to minimize each risk to show their satisfaction of the vendor's performance. Once a project is completed the WRR will summarize all issues that impacted the project cost or schedule and will identify what were the major reasons that the project was not able to go as initially planned.

The WRR purposes include:

1. provide basic project information;
2. tracks the progress in the projects schedule;
3. tracks all project risks to the project and how they will be mitigated;
4. tracks actual schedule delays and cost increases;
5. tracks who causes schedule delays and cost increases;
6. tracks contractor's performance with all risks of project;
7. assigns a level of severity to the project from the projects impacts; and
8. captures qualitative satisfaction ratings of vendor performance.

For CPPM to quickly understand how well a project is being managed a "risk rating" is assigned to the project in the WRR, the WRR calculates the risk rating by combining the cost increases, delays, and client satisfaction. Greater cost increases, schedule delays, and poor client satisfaction ratings will result in a higher risk rating; the higher the value of the risk rating the greater concern should be focused on the projects performance. These metrics collected in the WRR are easily transferred to an overall report that combines these metrics to portray the overall department efforts.

Directors Report

On average CPPM has fifty ongoing projects, by combining the individual WRR's into one Excel file called the "Director Report" that management is able to understand the overall measurement of the organization from both projects that are in progress and those that have been completed in the past. Figure 1 depicts how the WRR's for the individual projects are all captured in the Directors Report.

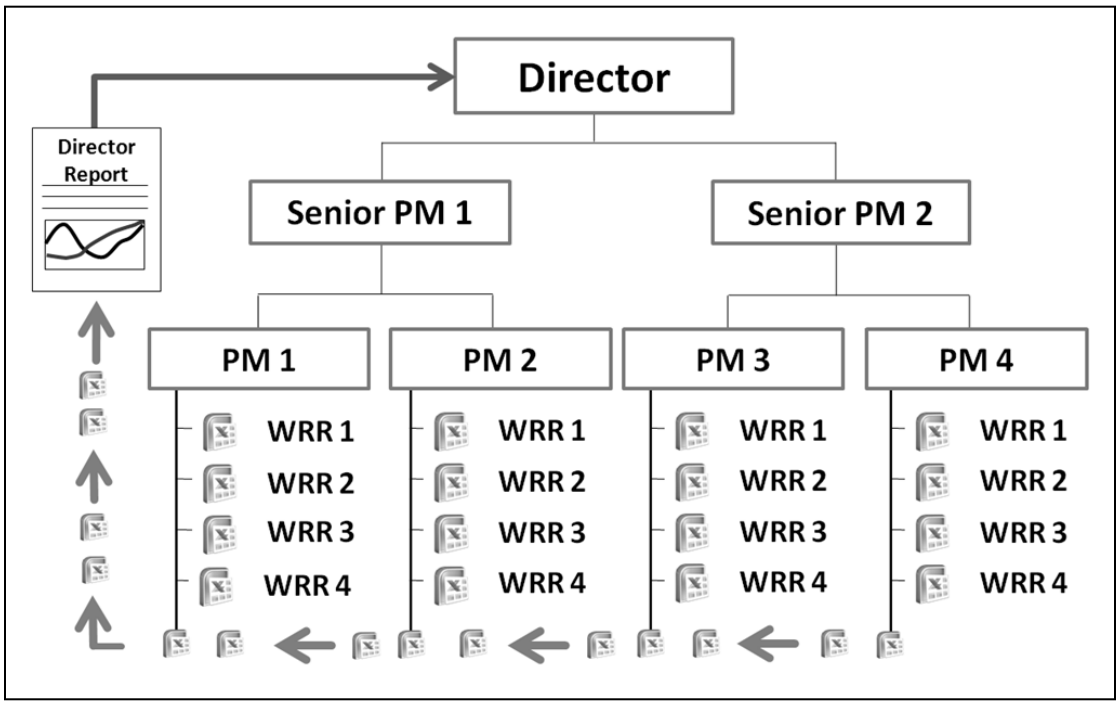

Figure 1 - Directors Report Collecting Individual Project Metrics

The Director Report is provided to the management team monthly to provide consistent performance metrics that can assist management and allow employees to understand areas which needs more focus. The Director Report contains eight different analyses that automatically update when the new weekly reports are submitted from the vendors. The following analyses are found in the Director Report:

1. Executive - is an overview of all completed and ongoing projects performance metrics and provides analysis of the metrics such as cost increases of the projects and the parties responsible for the increases. After five years of collecting data CPPM found that their clients were responsible for 74 percent of cost increases,

CPPM was responsible for 18 percent, designers were responsible for 8 percent, and contractors were responsible for 0.03 percent of cost increases.

2. Senior Project Managers – this analysis breaks down the projects that are under the two senior project managers responsible for the project managers.
3. PM – this analysis provides individual performance measurements for each project manager.
4. Risk Impacts – this analysis breaks down all the risks and their impacts to the projects, collected in twelve different subcategories such as: Client impact – scope change; CPPM impact – codes and permits; Contractor impact – sub/supplier issue; and unforeseen impacts.
5. Vendors – this analysis includes performance metrics on all contractors that have worked with CPPM on University of Minnesota projects.
6. Top 10 Risky Projects – the risk ratings that are assigned for each project on the WRR's are compared against all ongoing projects so management can see which projects have the most risk currently, so management can quickly see where additional support is needed.
7. Close Out – this analysis provides the overall close out ratings of the projects. At the end of each project a close out survey is completed and provides qualitative measurements of the vendors and projects performance. Satisfaction ratings are provided on the vendor and their ability to manage the project, cost management, schedule management, level of communication, quality of work, and overall professionalism.
8. Year to Year – analysis provides yearly performance metrics that can be used as benchmarks for the group to compare their ongoing progress.

CONCLUSION

In conclusion, the University of Minnesota capital improvement organization, CPPM, provides a case study in which a similar organization can follow to capture both quantitative and qualitative metrics of ongoing and completed construction projects. The implementation of the Weekly Risk Reports provided a way in which CPPM could collect the metrics through the contracted vendors and required very limited resources in their organization. The compiling of the WRR in the Director Report provides CPPM with overall performance measurements of their groups efforts to assist decision making. Because CPPM's full management team supported collecting performance metrics they were able to overcome obstacles with not having comparable benchmarks, issues with reluctant employees, and metrics that were beneficial in changing economic climates. Within a couple of years CPPM was able to provide beneficial performance metrics that were previously inaccessible and establish a consistent environment of accountability.

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CHANGE MANAGEMENT PRINCIPLES: BEST VALUE IMPLEMENTATION CASE STUDY

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ABSTRACT

Ever increasing competition in the global market has caused organizations in all industries strive towards greater effectiveness. Although individual companies may pursue effectiveness via a number of avenues, nearly all efforts to improve performance necessitate some level of organizational change implementation and management. Since much research exists in this field, the literature is reviewed to identify key change management principles from leading organizational change implementation models. An organizational change effort at the University of Alberta is examined, where an owner-driven quality program, the Best Value Model, is being implemented in the procurement and facilities and operations departments. A case study is presented in the University's pilot project implementation of best value through the procurement and delivery of a large-scale custodial services contract. The success of this organizational change effort is retrospectively assessed in terms of the leading literature principles of change implementation models. This is significant because it provides a real-time case study to further validate the existing literature knowledge in the field of organizational change management.

Keywords: best value, implementation, change management, organizational change, performance measurement.

INTRODUCTION

As global competition continues to become more disruptive, organizations worldwide are impacted by an accelerated pace of change (Hallencreutz and Turner 2011). Change efforts have become commonplace to sustain continual improvement in organizational performance (Blair and Meadows 1996). Yet while the need for successful change management practices has never been greater, implementing change is an extremely difficult task often met with failure. Many sources suggest that more than half of all change efforts fail to accomplish their original intended purpose (Choi and Behling 1997, Maurer 1996, Pascale, Millemann, and Vakolar 1997, Self and Schraeder, 2009). Balogun and Hope Hailey reported the failure rate for change

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initiatives to be as high as 70 percent (2004). In light of this fact, successful change management practices are rapidly becoming a required skill of managers in all industries (Todnem 2005).

In response to this trend, a review of the literature was conducted to identify key change management principles intended to increase the success rate of organizational change implementation efforts. A successful case study of change management is presented to describe successful practices, challenges, and the overall life cycle that impact organizational changes. This case study was also analyzed according to its adherence with suggested change management principles from the literature to provide further validation of successful change management practices.

LITERATURE

Organizational changes efforts are generally comprised of three main components (Kanter *et al*. 1992): the 'what' to change (including diagnostic tools to identify what problems and potential solutions exist), the 'how' to change (implementation models), and 'when' to change (whether change is needed and likely to be successful). Answering the question of 'what' to change can be challenging, as organizational changes occur in many forms including restructuring, reengineering, mergers and acquisitions, downsizing, and the introduction of new technologies (Walker *et al.* 2007). More recent notions suggest that what organizations really need to do is create a culture of agility or resiliency to encourage continuous innovation and adaptation in pursuit of a generalized set of objectives or principles (Denhard and Denhardt 2001, Weeks 2009). Although important, the questions of 'what' to change and 'when' to change were not addressed in this paper; rather, the focus was on 'how' to implement change. It is worth noting, however, that the presented case study followed the more recent pattern of working toward a set of generalized strategic objectives.

No matter 'what' the change, the process of successfully managing the implementation process is challenging. Many models of organizational change have been presented in the literature to describe the general steps within the change process, obstacles that are likely to be encountered, and strategies for success. No universal, step-by-step, all-purpose model can exist because not all changes are equivalent and various contingencies are critical factors: changes vary in scope, scale, operation level, targets, and objectives. Yet organizational change models do provide valuable principles that may benefit change managers in a wide variety of situations.

Change Management Models

Five change management models were reviewed to develop an understanding of recommended change management principles. The chosen models were selected due to their prominence, comprehensive nature, and varied research dates to gain a broader perspective into the existing knowledge within the field of organizational change research. The reviewed models included: Beer, Eisentat, and Spector 1990, Kanter *et al*. 1992, Kotter 1995, Armenakis *et al.* 1999, and Luecke 2003.

Change Management Principles

The key change management principles contained each within model were tabulated to develop an understanding of important practices to increase the success of organizational change efforts. Twelve leading principles were identified within the reviewed models and the frequency with which each change management principle appeared in the literature models was noted (see Table 1).

Change Management Principle	Beer, Eisenstat, Spector 1990	Kanter *et al.* 1992	Kotter 1995	Armenakis *et al.* 1999	Luecke 2003	Literature Frequency
Create Motivation for Change	X	X	X		X	80%
Analyze Problems & Needs	X	X		X	X	80%
Identify Solutions & Vision	X	X	X	X	X	100%
Establish Core Team Leadership	X	X	X		X	80%
Secure Executive Support	X	X	X			60%
Strategic and Tactical Planning		X				20%
Communicate Change Message	X	X	X	X	X	100%
Overcome Resistance	X		X	X		60%
Implement on Test Basis		X		X	X	60%
Expand to Intended Scale	X		X	X	X	80%
Transition to Institutionalization	X	X	X	X	X	100%
Long-Term Measurement					X	20%

Create Motivation for Change. Change efforts require coordinated efforts by a multitude of people, and these people are more likely to be engaged when there is a sense of urgency to motivate them (Kotter 1995). Luecke (2003) suggests a good rule of thumb is that the goals of the change cannot be achieved unless 75 percent of managers believe they must change from the status quo.

Analyze Problems and Needs. A broad review of the business is undertaken to come to a "joint diagnosis" of the roots of the current problems (Beer *et al*. 1990). Kotter (1995) observed that successful changes generally start with frank discussions about unpleasant facts where multiple parties are engaged.

Identify Solutions and Vision. The vision is a "picture of a destination aspired to, an end state to be achieved via the change" (Kanter *et al.* 1992). The vision is not necessarily a fully developed strategy, but is intended as the general purpose or goal for the movement; oftentimes, the details are worked out during implementation.

Establish Core Team Leadership. A visible leadership or Core Team must act as the leading change agents to implement the change. It is critical that these personnel have the operating know-how to accomplish the goals (Luecke 2003). Armenakis *et al*. (1999) stated that the most important trait of Core Team leadership is credibility in the eyes of other organizational members.

Secure Executive Support. Executives often control resources needed by the Core Team implementers and their backing is crucial (Kanter *et al.* 1992). Executive also supporters also wield the clout to further legitimize the change.

Strategic and Tactical Planning. The strategy is important to clarify high level goals, identify who is involved, and define roles and responsibilities of participants (Kanter *et al.* 1992). Tactical planning of specific projects or areas to change is important not only to help foster learning, but also to create short-term wins to maintain momentum and bring recognition (Kotter 1995)

Communicate Change Message. The change message is critical to helping implementation and should answer five key questions: (1) Is the change really necessary? (2) Is the specific change being introduced appropriate? (3) Can I/we successfully implement the change? (4) Is there high level, long term support for the change? (5) What's in it for the change recipients? (Armenakis *et al,* 1999).

Overcome Resistance. Resistance often crops up as employees feel shock, fear of the unknown, mistrust, fear of failure, loss of power, lack of perceived rewards (Armenakis *et al.* 1990, Luecke 2003). Education and communication to address these issues is an important responsibility of the Core Team change agents.

Implement on Test Basis. Starting change on the periphery enables flexibility, experimentation, and improvement before impacting the whole organization (Luecke 2003). Individual units or projects essentially become "developmental laboratories" for the change (Beer *et al.* 1990).

Expand to Intended Scale. Building on initial implementation and short-term wins aids the diffusion process. Beer *et al.* (1990) recommend letting each department or expansion area "reinvent the wheel" to find the most optimal way to integrate the change into their environment.

Transition to Institutionalization. Institutionalization is the condition where the change becomes "the way we do things around here" (Armenakis *et al.* 1999). The transition begins when the change has become more entrenched, the right people are in place, and the new team work setup is functioning (Beer *et al.* 1990).

Long-Term Measurement. Kanter *et al.* (1992) stress the importance of sustaining the change by continuously providing feedback mechanisms to show organizational performance in terms of results metrics (showing we have "done it") and process metrics (showing we are doing the right things to accomplish "it").

BEST VALUE IMPLEMENTATION CASE STUDY

The University of Alberta (UA) recently partnered with ASU to implement the Best Value Model. Located in Edmonton, UA is a large research intensive university with over 38,000 students and an annual budget of $1.7 billion. Results of the implementation strategy and progress to date are shared as a case study of change management, with the purpose of noting areas of success and difficulty while also shedding light on the life cycle a real-time organizational change effort.

The Best Value Model is an owner-driven program that aims to improve quality of projects throughout the contract lifetime. The model was initially developed at Arizona State University and has been tested on more than 900 projects in $4.7 billion in the services and construction industries with a 98 percent client satisfaction rating.

Initiation, Set Up, and Planning

UA was introduced to Best Value 5-6 years before they made the decision to proceed with implementation. After their initial introduction, the UA analyzed issues and opportunities present in their environment, ultimately identifying needs that provided motivation for members of the senior executive team to pursue Best Value. Once UA was partnered with the Best Value educators from ASU, they quickly moved to form a Core Team to function as leaders of the internal implementation effort. Key leaders of the Core Team included the Director of Supply Management Services and Director of Facilities and Operations, who effectively formed an implementation partnership between their two departments.

The Core Team met with ASU and formulated a strategic and tactical plan to accomplish specific goals. The vision for this effort was to improve organizational effectiveness via four strategic objectives: (1) become a measured organization, (2) increase preplanning and risk minimization through accountability, (3) procure and contract with high performing vendors, and (4) increase performance throughout

contract lifetimes. In order to accomplish this strategic vision, the tactical plan was to implement Best Value on select contracts as pilot projects to function as "hands on" learning experiences for the Core Team and additional change recipient members. If individual project were met with success, the University would then move forward towards creating more formal Best Value programs. This vision was shared with UA organizational members via education touch points and project planning meetings. Preliminary educational outreaches and pre-proposal meetings were conducted with external vendors to introduce them to Best Value concepts prior to their direct involvement with Best Value pilot projects.

Pilot Project Implementation

The first project to implement Best Value at the University of Alberta was for delivery of campus-wide custodial services. To prepare the vendor community for the philosophical shift in management approach, UA initially conducted information sessions for potential vendors prior to issuing the Request for Proposal. Information sessions were also provided for internal stakeholders. These educational outreaches helped to create a common level of understanding about the new business approach, address questions and concerns to increase stakeholder comfort, and orient participants in how to be successful in this new environment.

This pilot project was an intriguing change management case study due to the fact that the incumbent vendor from the previous contract participated, and was ultimately successful, in the selection process. The incumbent demonstrated high performance on the previous contract, as evidenced by their perfect 10 out of 10 past performance ratings (for their firm and project management personnel). Out of the eight respondent vendors, the incumbent achieved the highest evaluation score in all evaluation criteria (overall cost, risk plans, project team interviews).

The incumbent vendor then moved into application of new Best Value management principles into the pre-planning and execution of the contract. Successful implementation of these principles was an indicator of observed organizational change within the environment of a single large-scale contract. The fact that the incumbent vendor was selected made this pilot project an interesting case study in change management. The same vendor and client were able to work together successfully not only to operate successfully within an entirely new management structure, but also to achieve impressive project results. Three key differences in the new management principles marked this process as a distinct departure from 'traditional' practice:

Role Reversal. The purpose of the Best Value selection process is to identify and select the highest expertise team among the vendor community. With the understanding that the vendor is an expert in their field, better allocation of risk and responsibility are placed on the vendor for project planning, delivery, and measurement. In this new role, the vendor is both empowered and expected to bring value through vendor-generated project solutions.

Pre-Planning. Formal pre-planning with both parties enables coordination and alignment of expectations before work commences. A vendor-generated plan is produced which integrates client concerns, risk identification and mitigation, clear scope definition, defined interaction points between parties, and a full schedule of deliverables during project execution.

Performance Measurement. During the project, actual performance of the project team is measured against the plan set during the Pre-Planning phase. Each week, the vendor tracks unforeseen risks and any other impacts and manages mitigation strategies. The final project rating is affected not only by project performance but also timely and accurate risk measurement.

Pilot Project Results

Overall, implementation of the Best Value Model was extremely successful during pilot implementation at the University of Alberta. Project successes achieved were threefold: First, UA feared that competition on the RFP may be limited, in part due to the implementation of a new procurement and management model. Initially it was thought that UA would only be able to attract two local vendors to be able to bid on the ten-year, campus-wide contract. In fact, fifteen vendors expressed interest during early education stages and eight eventually proposed on the project. Second, initial estimates placed the project budget at $70 million over ten years, yet upon award the total contract value was estimated at $62 million. Up front savings of half a million dollars per year made the procurement process a huge success. Third, the role-reversal to greater enable vendor-generated solutions resulted in the awarded vendor taking full responsibility for quality assurance inspections, which allowed UA to reallocate three full time employees, providing further internal savings.

The Core Team involved in the pilot implementation project established regular meetings with executive sponsors. These meetings served as executive "touch points" to inform them of implementation progress, successes realized, and barriers encountered that the executives could help the team overcome. By communicating the success of the initial pilot project to their executive sponsors, the Core Team secured two additional years of funding to support the greater implementation and expansion of Best Value in their organization. The strategy of spreading good news stories (in addition to ongoing education efforts) was also applied to other stakeholders and the community as a whole to help minimize resistance.

Future Change Implementation Efforts

Following the success of the initial pilot project, the change management strategy at UA is planned to first include additional isolated pilot projects. The tactical plan is to run two additional pilot projects that will function as additional learning experiences for UA's implementation process and provide additional success stories. Strategically, these projects were selected to involve different industry communities (construction, architectural and consulting) in addition to the services community engaged on the first pilot. Furthermore, the Core Team has assigned different UA implementation personnel than those involved with the first project to begin expanding the internal exposure within their organization.

Beyond these pilot projects, future expansion is planned to include a full program of construction management services for all projects valued at $2.5 million and below, as well as a large-scale, campus-wide IT project. These programs will function as the main expansion efforts to transition Best Value into an institutionalized tool available to the University of Alberta for years to come. The long-term vision also includes a website or other communication platform to broadcast success in continued fulfilment of UA's strategic objectives. Performance measurements and results are envisioned to be reported on both the project and organizational levels.

CHANGE MANAGEMENT PRINCIPLES IN ACTION

The case study implementation of an advanced management system into a large university environment has been met with high levels of success from a change management perspective. This success has been realized at both the project and organizational levels, following an implementation strategy where individual projects are used to provide educational opportunities and facilitate "hands on" learning of executive sponsors, Core Group implementation leaders, and change recipients.

The presented case study of change management efforts to implement the Best Value Model at the University of Alberta was retrospectively analyzed to identify adherence to the change management principles espoused in the current literature body of knowledge. The University of Alberta's implementation effort did not actively follow the process steps and principles of any change models from the literature; rather, the self-contained experience of change management researchers at ASU was relied on to ensure the implementation process ran smoothly. The successful nature of the change effort to date provides the opportunity to analyze whether change management principles were unknowingly adhered to or ignored (see Table 2).

Table 2. Case Study Adherence to Change Management Principles

Number	Change Management Principle	Best Value Case Study
1	Create Motivation for Change	X
2	Analyze Problems & Needs	X
3	Identify Solutions & Vision	X
4	Establish Core Team Leadership	X
5	Secure Executive Support	X
6	Strategic and Tactical Planning	X
7	Communicate Change Message	X
8	Overcome Resistance	X
9	Implement on Test Basis	X
10	Expand to Intended Scale	Planned
11	Transition to Institutionalization	Planned
12	Long-Term Measurement	Planned

Of the twelve major change management principles suggested in the literature, nine have been implemented at the University of Alberta. The remaining three principles (expanding to a full change program, transitioning to institutionalization, and establishing long-term measurement) have already been planned as future activities in the continued change effort. The presented case study, which has seen great success to date, unknowingly followed the critical change management principles presented in the literature, further validating their applicability.

CONCLUSIONS

Successful change management practices have become a critical component to organizational success in maintaining long-term competitiveness. Academic papers have long noted the difficulty in implementing organizational change, with studies reporting failure rates to be alarmingly high. Change management principles have been recommended in the literature to increase the likelihood that implementation efforts are successful. An advanced management system called the Best Value Model has been applied to numerous projects and organizations and has been documented to

significantly improve quality and efficiency. The case study implementation of Best Value at the University of Alberta is a story of successful organizational change implementation which has resulted in tangible benefits to the organization. Analysis of this case study shows that the successful change management efforts at the University of Alberta did indeed follow the major change management practices proposed in the literature. Further testing at the University of Alberta is recommended to reach full program implementation and eventually lead to long-term sustainability and institutionalization. Yet current results provide further validation of the existing body of knowledge and provide a compelling case that utilizing certain change management principles correlate positively with successful change effort results. This analysis demonstrates the opportunity to educate executives and project managers in industry to help them become successful change managers.

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CONFINED SITE CONSTRUCTION AND ITS IMPACT ON PERSONNEL PRODUCTIVITY

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ABSTRACT

Inner city, confined site construction is quickly becoming the norm within the construction sector. The aim of this paper is to identify and document the effect, if any, that a confined construction site environment has on the productivity of on-site personnel. In order to compile the relevant information and attain appropriate results on the matter in question, a qualitative analytical approach is adopted. This process incorporates multiple cases studies from Ireland, Northern Ireland and USA. From the resulting case studies, a minimum of three individual interviews and focus group seminars are conducted to aid in the collection of the data while also assisting in the confirmation of the factors identified from a critique of the relevant literature. From the resulting case studies and discussions, a list of the key issues pertaining to the on-site productivity of personnel emerged and is documented as follows; 1) Overcrowding of personnel at workstations, 2) Lack of space for the effective movement of personnel on-site, 3) Numerous trades working within the one space on-site. Through identifying the issues highlighted and proactively mitigating or eliminating the factors detailed, on-site management professionals can strive to ensure maximum productivity from the industry's most important resource – people.

Keywords: city centre development, overcrowding, project management, site management, space.

INTRODUCTION

With the migration of populations from rural environments to urban centres, particularly over the last decade (United Nations, 2008), the need to develop these urban city centre areas also increases. This is predominantly due to the need to facilitate the services required by this influx of population (Waddell, 2002). With figures illustrating increased population densities throughout Europe, construction within this geographical area is set to face continued renewal and expansion (Gale and Fellows, 1990). With the development of these spatially restricted centres, there are numerous key points noted in the successful delivery and completion of inner city confined sites. Some examples include increased material management (Spillane, *et al.,* 2010; 2012), overcrowding (Singer, 2002) and increased health and safety (Spillane, *et al.,* 2009; 2011a; 2011b). But fundamental to this is the effective

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utilisation of the industry's most important resource – its people (Egan, 1998). Winch (2010) indicate that personnel account for a significant proportion of the costs attributable to a project while Druker and White (2007) outline that effective personnel management is often undervalued, hence, there is a high possibility of underutilisation and thus, reduced productivity of this important resource in the industry. Where interruptions occur in the fluidity of personnel output on-site, there is a possibility of uneven flow of work, thus resulting in reduced productivity (Thomas, 2000). In order to sustain assigned project completion parameters, compressing the project schedule is sometimes suggested, but often with adverse consequences (McDonald and Zack, 2007). However, the construction industry is renowned for being notoriously unproductive, particularly in relation to labour productivity (Koskenvesa, *et al*., 2010), thus it has received attention from various academics vying to resolve the issue at hand (Koskela, 1992; Thomas and Napolitan, 1995; Ballard, 2002; Ballard and Howel, 2003). In order to assist on-site project managers with the onerous task of effectively managing the construction process, it is beneficial to identify the impact the site environment has on personnel productivity on-site. Through the use of a qualitative approach including individual and focus group interviews coupled with the inclusion of three case studies, it is possible to gain an insight into industry perceptions on the issue.

Three case studies are identified for inclusion in the research, with a minimum of three on-site professionals questioned with regards personnel productivity, in respect to their particular confined construction site. By introducing mind mapping, it is possible to identify and disseminate the impact of constructing sometimes intricate structures in an environment where space is often to the fore, particularly in relation to being a finite resource requiring effective, continuous management (Tommelein and Zouein, 1993). In documenting the factors which impact personnel productivity on a confined construction site, it will aid on-site project managers to identify the critical factors and in doing so, will asset in the implementation of mitigation measures to reduce or eliminate the resulting reduction in productivity on-site. Thus, through ensuring that optimum levels of productivity are not only achieved but also sustained, the possibility of achieving successful project completion is ever more attainable.

LABOUR PRODUCTIVITY

Labour productivity can be defined subjectively in analytical form or in a broader sense. One of the more universal definitions is provided by Hanna, *et al.,* (2008), where, from an economists point of view, labour productivity is defined as the ratio between inputs; such as labour, material and plant, and outputs; the value of completed work. This view is also shared by Schwartzkopf, (2004) who elaborates on the definition by highlighting the various methods of labour productivity. These include 'direct methods' such as percentage of work complete, 'work sampling' which involves reviewing the work being undertaken over time. In addition, 'Craftsman questionnaire sampling' and 'earned value methods' are also included in the methodology reviewed. From a construction manager's point of view, productivity can be defined as the 'ratio between earned work hours and expended work hours' (Hanna, 2008). Within labour productivity, there are a number of factors which have been identified as detrimental to labour productivity on-site. Some of these factors include over manning (Hanna, 2007), stacking of trades (McDonald and Zack, 2007),

lack of materials (Thomas and Napolitan, 1995), extended overtime (Hanna, *et al.,* 2005), changing working time (Ibbs, 2005) and shift work (Hanna, *et al.,* 2008), but to name a few. However, one of the more pronounced factors adversely effecting personnel productivity is that of the construction schedule (Ritz, 1994) and more particularly schedule compression (Thomas, 2000) – a methodology which outlines the systematic approach in the monitoring and control of productivity.

Productivity of labour has proved a fickle topic, particularly in regards to the construction sector. In the case where additional resources are introduced to a particular work package, Hanna, *et al.,* (1999) argues that the resulting stacking, particularly of trades, may result in inefficiencies. Tse and Love (2008) share the viewpoint that overtime and shift work are more cost effective ways of schedule acceleration although it must be noted that a decline in productivity has been linked where overtime is introduced on a long-term basis and thus, should only be used as necessary. In addition, Ibbs (2005) compounds the issue by documenting that late change and lack of notice exasperate the problems in regards to productivity and therefore must be avoided where possible. Overcrowding is one of the core factors attributable to confined site construction (Spillane, *et al.,* 2011b) with both personnel (Cotton, 2009) and plant and equipment proving detrimental (Uher and Loosemore, 2004; Kim *et al*., 2005). Makulsawatudom and Emsley (2001) establish, during a study of factors affecting craftsmen's productivity, that overcrowding is ranked as the fourth most influential factor, with only lack of materials, lack of equipment and incomplete drawings causing a greater loss in personnel productivity on-site. Makulsawatudom and Emsley's (2001) report found that project managers rank overcrowding as the sixteenth most significant factor, thus further compounding the issue and the severity of the research in question. Finally, a leading study by Thomas, (2006) concludes that overcrowding is directly correlated to craftsman's productivity, but in order to assist in associating these results with that of a confined site construction, it is necessary to review the findings and to consider the results in relation to that of a spatially restricted environment.

METHODOLOGY

In order to achieve the research objective, a primarily qualitative approach is adopted. Firstly, a literature review is conducted on the topic of personnel productivity, with particular emphasis on the construction sector. Secondly, to capitalise on the information acquired along with verifying the factors identified, while also eliciting further possible factors, three case studies are identified for inclusion. The case studies included for discussion are a low rise, high rise and underground services contract located in Ireland, Northern Ireland and USA respectively. Each case study is selected after being shortlisted from a total of 12 possible case studies and is chosen due to the availability of individuals to participate in the research, the internal varying intricacies on-site, the scale of the project in question and the overall complexities associated with each, due to the confined nature of the projects in question. Specific emphasis is then placed on productivity within the construction sector while also reviewing the construction sector as a whole. Thirdly, with regards to the qualitative data collection, a number of construction sector companies within each case study are approached and requested to participate in the research through individual interviews and also focus group seminars. Based on the numerous factors in the literature, analysis of three industry specific and diverse case studies, examination of individual

interviews and also focus group seminars, a plethora of factors are identified for further qualitative analysis and discussion.

ANALYSIS

From the exhaustive list of factors identified, a process of factor examination through the use of mind mapping and causal loop assessment is undertaken (Figure 1). By reviewing the results of the qualitative analysis by means of confirmatory discussions, it is then possible to identify the leading impacting factors of personnel productivity in a confined construction site environment. Table 1 documents the 15 factors identified in relation to the case studies chosen, tabulated in order of preference as prescribed by the interviewees questioned.

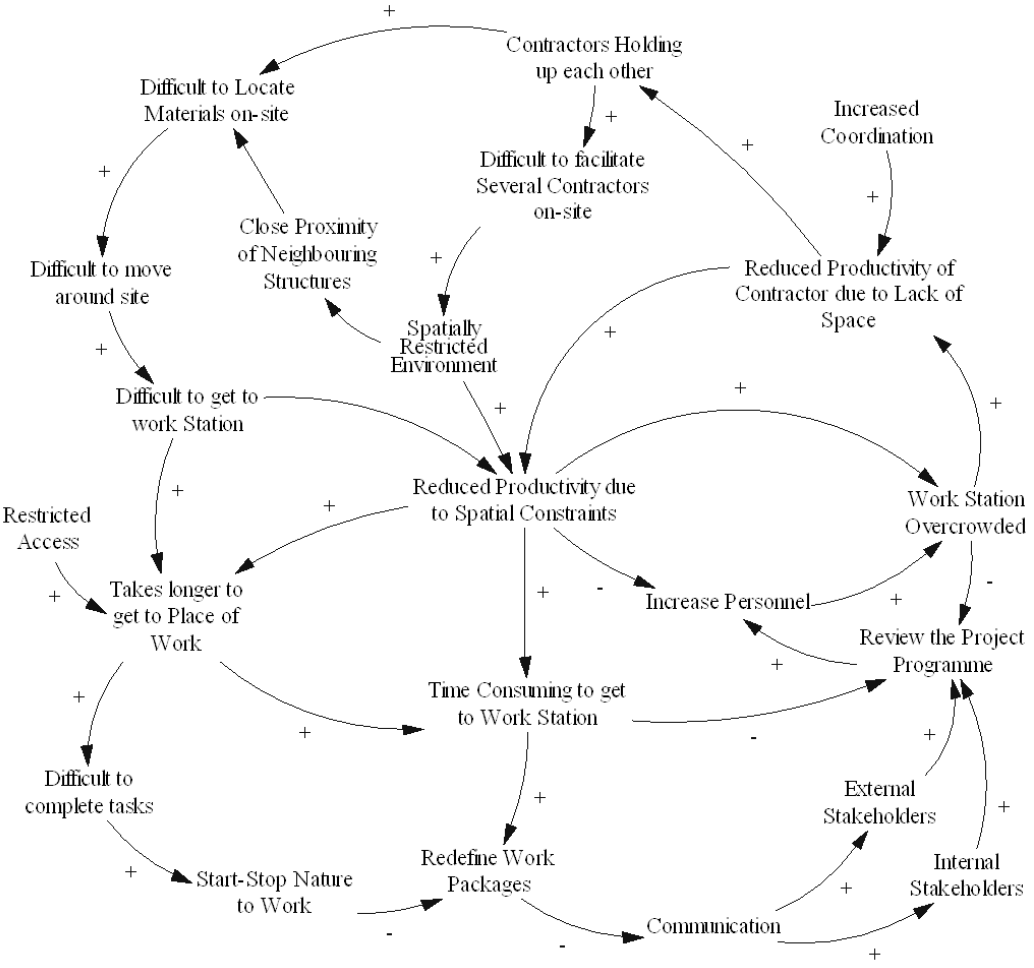

Figure 1: Causal loop of factors impacting personnel productivity

Factor	Case Study 1	Case Study 2	Case Study 3
Overcrowding of personnel at workstations	X	X	X
Lack of space for the effective movement of personnel	X	X	X
Numerous trades working within the one space	X	X	X
Difficult to transport material because of the lack of space	X	X	
One contractor holding up another due to the lack of space	X	X	X
A risk to personnel because of vehicular traffic on-site	X		X
Difficult to facilitate several contractors at one work location	X	X	X

Reduced personnel output due to inadequate space		X	X
Difficult to complete tasks due to the spatial restrictions	X	X	X
Concern of the close proximity of neighbouring structures	X	X	
Start-stop nature to activities due to overcrowding		X	X
Difficult to get to / from the work place	X	X	X
Difficult to co-ordinate personnel in the assigned spaces		X	
Poor project programming resulting in overcrowding	X	X	X
Restricted access at work stations to complete work tasks	X	X	X

Table 1: List of factors identified and corresponding case studies

DISCUSSION

The most prominent factors identified are listed accordingly, based on cluster, hiset and domain analysis of the extracted datasets using mind mapping software. Each of these factors are core to each of the discussions and resulting individual case studies documented and reviewed and thus, are prevalent within a confined site environment, regardless of being a low rise, high rise or underground development.

Overcrowding of personnel at workstations

From the qualitative analysis and the case study examination, the leading factor identified by all and which resonates throughout each case study, interview and focus group is the issue of personnel overcrowding at workstations. Thomas and Riley, (2006) compound the severity of the issue by documenting that congestion in the workplace is detrimental to labour productivity and thus, must be avoided at all costs. In addition, Mokobane, (2006) furthers this point by indicating that productivity is adversely affected due to the increased health and safety concerns which result in reduced productivity within such environments. Where the possibility of overcrowding at workstations is realised, on-site management must take all possible actions to mitigate or eliminate the adverse effects of such an environment, in order to ensure that productivity of personnel is not adversely affected.

Lack of space for the effective movement of personnel

The second factor identified is the lack of space which results in impairing the effective movement of personnel in and around site. Again, as before, the leading trait identifiable is the lack of space and the resulting adverse effect on personnel productivity on-site. Thomas and Riley (2006) also identify difficulties in the movement of personnel on-site as one of the leading issues in relation to productivity with Ning, *et al.,* (2011) also highlighting the difficulties with multiple trips by personnel on-site. Therefore, the negative impact of this factor on personnel productivity is firmly rooted and must be acknowledged, thus enabling on-site management to proactively manage the limited space, with the aim of ensuring the effective movement of personnel on-site, thus improving the overall productivity.

Numerous trades working within the one space

The third and final factor for discussion is again noted in all three of the case studies and encompasses stacking of trades on-site and particularly within one location on-site. McDonald and Zack, (2007) argue that this practice has a detrimental effect on productivity on-site. In addition, they highlight that each trade should have sufficient space within their work environment to ensure that they can perform their tasks sufficiently while not being interfered by either oncoming or trailing trades. Furthermore, they conclude that the practice of schedule acceleration can also have a

negative effect on trade stacking, but this factor is exasperated in confined site environments, where spatial restrictions are evident throughout.

CONCLUSION

With the continued development and expansion of urban centres (Heimlich and Anderson, 2001), the need for redevelopment has continued at pace. One of the negative aspects of developing within this environment is the spatial deficiency which persists in the vast majority of inner city sites. This can result in a number of issues, one of which is the negative effect on labour productivity on-site. As documented, by adopting a qualitative approach in the form of a critique of the literature along with mixed method case study analysis individual interviews and focus groups, 15 factors are identified which negatively contribute to a reduction in personnel productivity on inner city, confined construction sites. The subsequent leading negative impacting factors are 1) overcrowding of personnel at workstations, 2) lack of space for the effective movement of personnel, and 3) numerous trades working within the one space. Where on-site management professionals are faced with ensure project success in such a spatially restricted environment, the findings presented are of particular interest and benefit. By acknowledging and counteracting the factors identified, it is possible to mitigate the negative impact of reduced labour productivity, thus increasing the possibility of ensuring project completion and thus, project success.

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DIVERSIFICATION AND PERFORMANCE OF QUANTITY SURVEYORS IN NIGERIAN CONSTRUCTION INDUSTRY

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ABSTRACT

Quantity surveying profession is fast becoming a dynamic profession due to the rate at which professional Quantity Surveyors diversify into other business endeavors. In recent times, it was discovered that Quantity Surveyors are diversifying from their traditional roles due to expansion of knowledge and the rapid high cost of living facing the present economy. This research was conducted for the purpose of finding out the effects the diversification has on the performance of Quantity Surveyors in the Nigerian Construction Industry. The study outlined the traditional roles of the Quantity Surveyor, identified the various factors that cause a Quantity Surveyor to diversify from his traditional roles and the areas which the Quantity Surveyor diversifies into. The results of the survey showed that diversification have both positive and negative effects on the performance of Quantity Surveyors.

Keywords: Construction industry, Diversification, Performance, Traditional-role.

INTRODUCTION

Construction professionals in contemporary business organizations are faced with problems of Business survival over the past decades, under the premise that growth is a vital element for business survival, a firm can grow and develop its core competencies either internally by investing in and nurturing within-firm resources or externally through diversification into other areas of businesses.

Change is occurring in the world today and the pace seems to be accelerating faster than ever. Change management has, in recent years, become a very important aspect in the study of organizational behavior and same applies to practice of professional quantity surveyors.

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Quantity Surveyor (QS) is a professional working within the construction industry concerned with building costs. It is a profession that provides a qualification gained following formal education, specific training and experience that provide a general set of skills that are then applied to a diverse variety of problems. Predominantly these relate to costs and contracts on construction projects.

Nigerian Institute of Quantity Surveyors (2004) defined a quantity surveyor as the expert professionally trained and experienced in dealing with construction cost, construction management and construction communication. Studies of Ashworth and Hogg (2002) describe the Quantity Surveyor as the one who 'ensures that the resources of the construction industry are utilised to the best advantages of society by providing, inter alia, the financing management for projects and cost consultancy services to the client and designer during the whole construction process.'

Olusoga (2006) observed that Nigerian quantity surveyors of older generation were more of experts in the costing, cost monitoring and control as it relates to building projects which they were respected for by their sisters' professionals.

Although it is true that today's quantity surveyors want to expand the horizon of their practice as observed by Seppanen (2002). However, most of the expansion by practising Quantity Surveyors in Nigeria as the case may be is into costing of engineering projects which is still within the traditional role of the older generation of quantity surveyors especially in the developed world.

Jagun (2006) opined that the quantity surveying profession is faced with great challenges in Nigeria. Steven (1990) observed that quantity surveying is becoming an increasingly influenced occupation while Sigle, Klopper and Visser (2000) believed that these clients are increasingly demanding application of value management to their projects.

The quantity surveying profession is imperative in construction industry and the role of the quantity surveyor is characterised in several ways. However, Concerns in the coming decade will be dominated by the need to anticipate and satisfy changing client requirements amidst other demands for better standard of living by construction professionals in Nigeria (Aje & Awodele 2006). This called for a need to examine the present performance of Nigerian quantity surveyors in their quest for better service delivery viz a viz their involvement in other forms of businesses outside their core professional role. The research problem then lies in examining whether Diversification affects the performance of Quantity Surveyors in the discharge of their professional responsibilities.

Who is a Quantity Surveyor

The quantity surveyor (QS) is a professional working within the construction industry concerned with building costs. Though limited to building, the definition added that the profession provides qualification gained through formal education, specific training and

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experience that provide a general set of skills that are applied to a diverse variety of problems which relate to costs and contracts on construction projects.

The Nigerian Institute of Quantity Surveyors gives a more compact and definite definition of the QS as the professional responsible for total cost and procurement management and concerned with financial probity and value for- money in the conceptualization, planning and execution of development projects in the building and construction sector of the economy.

Quantity surveyors are called by so many names all over the world such as cost engineers, building economists, cost managers, construction accountants, and different authors have adopted these different names in different studies (Seeley and Winfield, 1999; Kelly and Male, 2006) and in Nigeria, (Ajanlekoko, 2004; NIQS, 2004; Babalola, 2006; Odeyinka, Oladapo & Akindele 2006;).

Competent quantity surveyors must have a range of skills, knowledge and understanding which can be applied in a range of contexts (Hassall, Dunlop & Lewis, 1996).

The Role of a Quantity Surveyor

The role of the Quantity Surveyor has changed over the years and the present Quantity Surveyor exhibits their competencies in diversified paths within the construction industry as well as beyond the boundaries of the construction industry. Among the evolved and developing paths of the profession, finance is a lucrative industry providing a broad scope of opportunities for Quantity Surveyor to undertake careers in insurance and various finance positions in banks or as corporate finance entities.

Quantity Surveyor usually reports to Project Manager or Project Director and provides advice in the decision-making process throughout the management of a project from initial inception to final completion. The Quantity Surveyor handles estimating and cost control, the tendering process and, after contract award, the commercial interface.

Quantity Surveyors should be able to carry out estimating and measurement of construction works prior to tender, producing the bill of quantities; produce tender documentation and manage the tender process; clarify and evaluate tenders; and manage the resultant contract through monthly valuations, variations control, contract administration and assessment of claims.

Some Quantity Surveyors are trained in techniques of cost control. Others emphasise contracts management.

Some Quantity Surveyors specialise in project management and running multi-disciplinary projects, the Quantity Surveyor background being a good foundation for understanding the complexities of modern large-scale projects.

Factors Leading to Diversification by Quantity Surveyors

The last decade of the 20th century and indeed the past 20 years witnessed significant changes in the construction industry in the UK particularly following the global recession

of 1990-1995 (Cartlidge, 2006; Ashworth & Hogg, 2002) which took its turn on Nigeria. The reasons for these changes include; Expanding scope and scale of construction projects due to massive industrialization and globalization, Emergence of new markets for construction products which led to reduction in public sector spending with massive increase in large private Sector led investments, Changes due to client-led demand since the traditional practices centered on quantities were considered a low-cost activity, Contractor-led changes due to emergence of large firms with diverse knowledge and capabilities.

Some other reasons for the changes in the construction industry as identified by Harun and Abdullahi, (2002) is expansion of knowledge and learning. It should be noted here that financial skills of Quantity Surveyors is now subservient to knowledge, innovation, entrepreneurship and creativity, particularly in business and commerce (Drucker, 1993). Also, the Information Technology Revolution, Globalization and World Economic Growth, Increased Clients' Expectations (Moore, 1984; Bates, 1986; Cattell, 1994). Smith (2010) highlighted; Fee cutting and bidding among Firms. Firms clearly recognize the fact that project cost management is not the exclusive domain of the quantity surveying profession.

Some quarters are dissatisfied with the quality of graduates from university courses particularly in terms of core skills in measurement and construction knowledge. Some firms have found that graduates are not interested in the technical measurement role.

Effects of Diversification

Corporate diversification has the potential to either enhance or destroy value and performance of a firm from discharging its core professional responsibilities. Regarding the value-enhancing aspects of diversification, Lewellen (1971) argues that diversified firms have greater debt capacity than do single-segment firms, which implies a larger debt tax shield and higher firm value. Chandler (1977) opined that diversification may lead to operating efficiency by enhancing economies of scope and increasing managerial coordination.

On the other hand, diversification may lead to value destruction, which is ultimately attributable to information asymmetries. First, the benefits of diversification described by Chandler (1977) may be offset by costs associated with increased information asymmetry between headquarters and individual divisions (Harris, Kriebel, & Raviv 1982). Second, in the presence of asymmetric information the potential for residual agency problems between management and shareholders exists. For instance, rather than using internal capital markets as a means of solving the underinvestment problem, Denis, Denis, and Sarin (1997) document negative association between the level of diversification and the equity ownership of executives as well as the presence of large blockholders; however, they find no evidence to support the notion that ownership structure is associated with the diversification discount once the decision to diversify has been made.

Quantity Surveyors have really taken on the challenge of diversification to better meet and serve industry demands. This indicates, in part at least, a proactive approach to change by many firms. They also demonstrate the very broad range of employment and business opportunities available for the modern day quantity surveyor. The involvement of Quantity surveyor in other professional disciplines further demonstrates the overlapping nature of the profession and the increasing need for quantity surveying professionals to work as part of multi-disciplinary teams on projects.

Due to rapid changes and diversification in both the profession and the construction industry, it has become more important to produce well qualified and competent graduates to meet the challenges and the increasing demand of the profession.

Diversification is one of the strategies for reducing firm risk or seeking growth opportunities to sustain the firm's life. As a result of diversification, Quantity Surveyors are not only deviating from their traditional roles but also looking for new ways to broaden their knowledge in the already existing traditional roles. Some of them are briefly explained below.

RESEARCH METHODOLOGY

The study focused on professional Quantity Surveyors, practicing in Nigeria. The primary data were collected directly from the field through the use of structured questionnaires, field observation and oral interview to professional quantity surveyors. The questionnaires were structured and administered in Abuja during the International Conference organized by The Nigerian Institute of Quantity Surveyors (NIQS) and Quantity Surveyors Registration Board of Nigeria (QSRBN) Round Table & Assembly. These enhance easy distribution of the questionnaires and enhance genuine responses from the respondents. A total of 120 questionnaires were administered out of which 91 was returned and subsequently used for analysis. Simple percentile was used to analyse the respondent background information, Factor analysis was used to reduce the variables and severity index of the factors was then determined and used to rank the variables according to their degree of importance.

RESULTS AND DISCUSSION

Table 1. reveals that 12% are professionally qualified/registered to practice quantity surveying, 6% are Fellow of NIQS (FNIQS), 42% are Corporate members of NIQS (MNIQS), 40% are probationer members of the NIQS. The table shows that all respondents are professional Quantity Surveyor. This gave the assurance that the responses could be relied upon.

Table 1: Professional Qualification

Professional Qualification	Frequency	Percentage %

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RQS	6	12
FNIQS	3	6
MNIQS	42	42
Probationer NIQS	40	40
Total	91	100

The results of severity index of negative effects diversification has on the performance of quantity surveyors in the Nigerian construction industry, ineffective Quantity Surveying practice was first with severity index of 62%, followed by lack of competitive edge in the Quantity Surveying practice, 56% for general decline of the Quantity Surveying practice, 55% for Inefficiency in assigned traditional Quantity Surveying duties while Delay in completing tasks has 54%.

Table 2: Negative effects diversification has on the performance of Quantity Surveyors in the Nigerian Construction Industry

NEGATIVE EFFECTS	SEVERITY INDEX %	RANK
Ineffective QS practice	62	1
General decline of the QS practice	56	3
Lack of competitive edge in the QS practice	58	2
Inefficiency in assigned traditional QS duties	55	4
Delay in completing tasks	54	5

Table 3: Positive effects diversification has on the performance of quantity surveyors in the Nigerian Construction Industry

POSITIVE EFFECTS	SEVERITY INDEX %	RANK
Education	42	4
Research producing new and improved methods	47	2

Increased awareness of Quantity Surveyors	43	3
Quantity Surveyors involved in politics formulating policies in favour of the profession	61	4

Positive effects diversification on performance of quantity surveyors in the Nigerian construction industries is shown on Table 3. Politics formulating policies in favour of the profession was ranked first with severity index of 61%, and increased awareness of Quantity Surveyors has 43%, while Education has the least severity index of 42%.

CONCLUSION

A quantity surveyor is referred to as 'Jack of all trades and master of all'. This simply means he has broad knowledge about alot of activities in the construction industry and will easily fit in and deliver on any task given to him.

Based on the findings, from the results of analysis, the study showed that quantity surveyors do not fully concentrate on their traditional roles but instead are looking for quick ways to get more money by diversifying into other areas for personal interest, gaining more knowledge, to meet up with the high cost of living and increased customer expectation.

Diversification affects the quantity surveying practice positively because it further widens the knowledge base of the professionals and produces better quantity surveyors. It also affects the profession negatively, these is evident from the level at which QS abandon their traditional roles and take up other duties which may not be related to the quantity surveying profession or the construction industry as a whole.

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IMPROVING PROFESSIONALISM IN CONSTRUCTION CUSTOMER SATISFACTION: THE PINNACLE APPROACH

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ABSTRACT

The measurement of customer satisfaction forms an integral part of improving construction operations and enhancing customer experiences, so creating competitive advantage and increasing revenue. At the heart of the customer experience lies their overall satisfaction, which is fundamentally linked to organisational strategies and exhibited professionalism. Contemporaneous evidence suggests a lack of any "standard" service quality model used by all construction professionals to monitor customer satisfaction and yet, construction professionals need to measure customer satisfaction using an "appropriate and atypical" technique. A factor analysis meta-model is proposed that integrates a number of approaches to customer satisfaction management and drives towards a "Pinnacle Approach": linking the predominant influences of building and service quality; organisational; and, human factors. Weightings attaching to each of the influence factors, within the customer satisfaction and factor analysis meta-model, aid in identifying the predominant influences on customer satisfaction and enable construction professionals to prioritise areas for improvement. The model also allows exploration of previously unconsidered factors, thus ensuring professional fluidity at every level. As organisational practices come closer to the peak of the triangle, so professionalism will increase creating positive customer satisfaction and business benefits.

Keywords: Construction, Customer Satisfaction, Service Quality.

INTRODUCTION

Customers are valuable assets for organisations, but are often costly to acquire and retain (Jakštien *et al.,* 2008). In recent years, the construction industry has had the difficult task of encouraging new buyers to purchase homes in the midst of failing markets, low consumer confidence and potential credit difficulties. As pressures increase and home buyers become better informed; proactive construction organisations are realising the need to redesign and redevelop their business strategy to practice good customer relations (Forsythe, 2007). In an attempt to alleviate such issues, service quality and customer satisfaction benchmarks are becoming important means of gaining a competitive advantage within the marketplace and increasing

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profit. As a result, house builders need to identify and understand buyer needs in order to continuously improve their service level. The majority of studies focus on build satisfaction related to the construction process, including that of defects at handover. However, very few have combined both build quality and customer experience in a single conceptual review. As such, this research paper aims to produce a factor analysis meta-model encapsulating a variety of individual service quality models and combining them to create a single point of reference for all construction professionals. In addition, the relationship between build experience and customer experience will be assessed and related to overall professionalism. Throughout the research the "customer" can be defined as anyone who procures goods or services from an entity, including the client and all other construction professionals.

CUSTOMER SATISFACTION

Customer satisfaction has become an important business driver and managerial focus in many professional areas, including construction (Kotler, 2000), where customer satisfaction is regarded as an aspect of quality (Yasamis *et al*., 2002) and an important indicator of project success (Delgado-Hernandez and Aspinwall, 2005). Managing customer satisfaction is therefore at the forefront of many business agendas with an increasing tendency towards customer orientation, in an attempt to create continuous improvement whilst gaining benefits of improved communication, increased customer loyally, increased referral rates and superior economic returns. As the cost of retaining an existing customer is less expensive than seeking new ones, understanding customer purchase intentions is a vital means of forecasting purchasing behaviour (Spreng *et al.,* 1996). Current research suggests that purchase intentions increase as service recovery increases. Similarly, poor service delivery is likely to hinder future purchase intentions. According to Himansu (2009) there are four major factors which influence the purchase intentions of the customers: Psychological Factors, Social Psychological Factors, Sociological Factors, and Economic Factors.

SERVICE QUALITY

Over the years, the term "service quality" has been widely discussed by various researchers such as Parasuraman *et al.,* (1985), Haywood-Farmer (1988) and Sweeney *et al.,* (1997). An interesting study undertaken by Seth *et al.,* (2005) reviewed and appraised some of the most popular service quality models. Although the research discussed all of the major observations of each of the models, all were looked upon in isolation. Similarly, evidence suggests a lack of any "standard" service quality model used by all construction professionals to monitor customer satisfaction and yet, construction professionals need to measure customer satisfaction using an "appropriate and atypical" technique. Figure 1 shows a single factor analysis "meta-model" encompassing all of the factors which should be considered when assessing the level of service that a customer has received. The model has been created by linking 10 of the most popular service quality models, dating from 1984-2000. Although several service quality models have been developed since 2000, the majority of these are based on the "original" models which remain the most widely recognised and commonly used models to date.

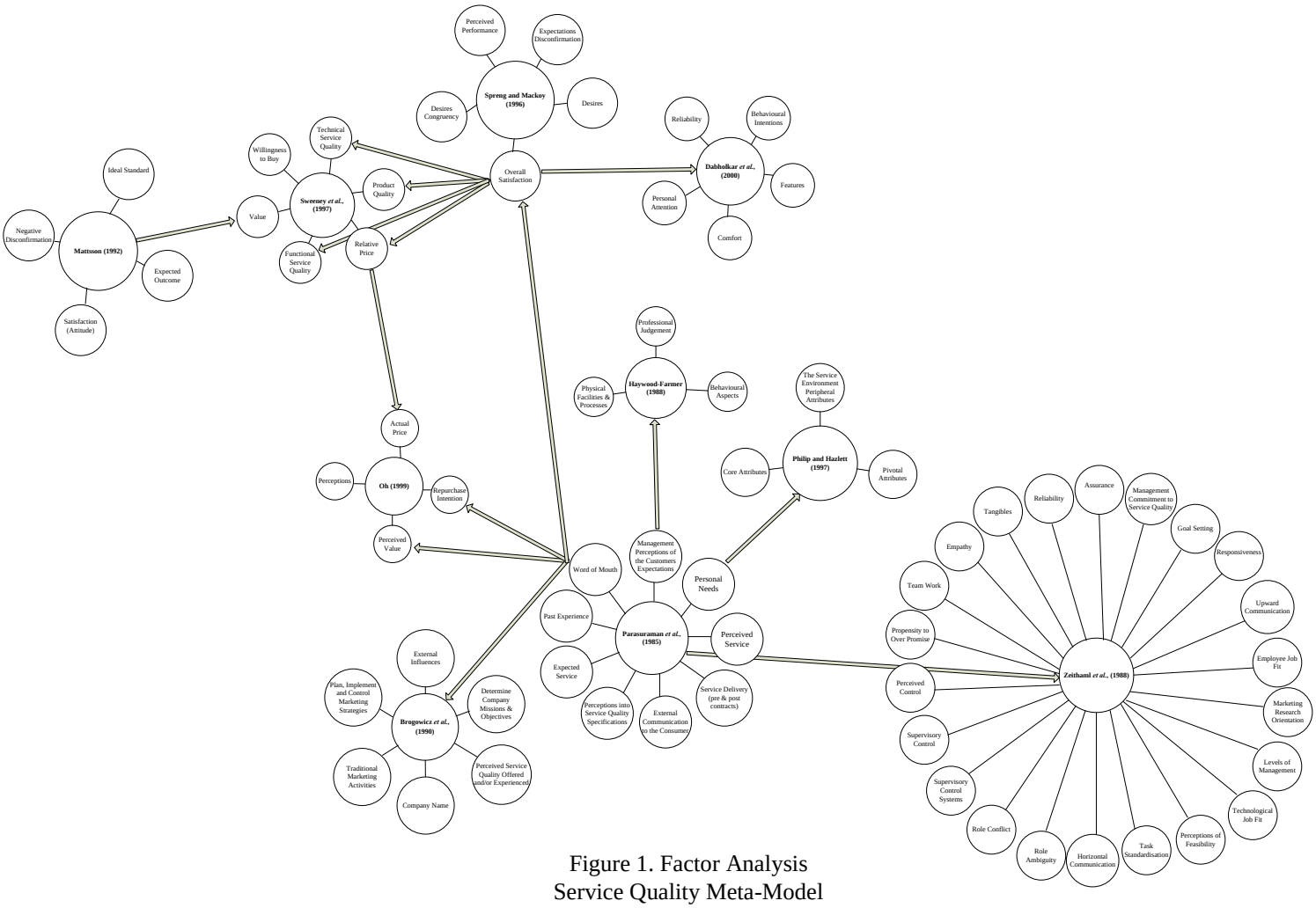

Figure 1. Factor Analysis
Service Quality Meta-Model

THE "PINNACLE" OF SATISFACTION DRIVING PROFESSIONALISM

The idea of "professionalism" relates to overall customer satisfaction and the service provided by professionals. In order to obtain "professionalism" accreditation, all construction professionals – including designers, architects, engineers and house builders need to understand the influence of customer satisfaction and the potential consequences of their actions on the business model. This includes "learning from their projects, forging better links between practice and research and embedding knowledge in their organisations and the wider industry" (Bordass, 2011). Similarly, organisations should "take account of outcomes during briefing, design and construction" (Bordass, 2011) and use such information to provide a superior build experience for the customer in terms of the time, cost, quality and safety of the build. Finally, organisations should also consider overall customer experience in terms of expectations, needs, wants and desires related to the service delivered. =

Build and Customer Experience

Traditionally, construction is not a customer orientated industry (Dulaimi, 2005). As a result, evidence suggests that the perceived build quality e.g. in new housing, is lower than customers would expect, often resulting in high levels of dissatisfaction (The Housing Forum, 2000, cited by Auchterlounie and Hinks, 2001). In order to increase

customer satisfaction, project managers should; have a clear understanding of the clients brief, ensure positive contractor involvement, select the most appropriate design team, encourage accurate reporting, ensure supervision and control during construction and implement effective evaluation and feedback methods. As a result, it is vital that managers achieve the right balance of time, cost, quality and safety in order to build lasting relationships, increase satisfaction and secure repeat business. According to Johnston and Kong (2011), customers will have an "experience", every time they encounter a service, whether it is good, bad or indifferent. A customers experience is inherently unique and will differ from individual to individual, with varying interpretation of the service received (Pine and Gilmore, 1998). The overall customer experience will influence future behaviour associated with purchases, recommendations or complains, which are all likely to effect an organisations reputation, bottom line and competitive advantage.

Customer Perceptions and Expectations

There are numerous factors which may influence the purchase decisions of potential buyers including perceived risk, price perception, customer's income and need stratification. Researchers, such as Sirgy (1982) believe that customers choose products which are consistent with their perceptions; however, as individuals perceive situations and interpret information differently, customer behaviour is often difficult to predict (Drew and Bronkhorst, 1996). The more experience the customer gains or more knowledgeable they become, the more likely that their perceptions will change, resulting in an increased focus on the service consumption.

Similarly, expectations play a pivotal role in most modern day discussions surrounding service quality (Coye, 2004). Very often customer expectations relate to how well the service encounter has met overall expectations in terms of being "true or false, good or bad and desirable or undesirable" (Clow *et al.,* 1997). Similarly, expectations may also be "fuzzy or focused, implicit or explicit, unrealistic or realistic" (Ojasalo, 2001). However, many customers are willing to accept a degree of flexibility known as the "zone of tolerance" (ZOT) (Zeithaml and Bitner, 2000) which highlights the difference between what is "desired" and what is considered "adequate" service (Dean, 2004). The wider the ZOT the more accepting customers are of variations in the level of service received.

Needs, Wants and Desires

Gaining a clear understanding of what customers need, want and desire is one of the most effective ways of creating a positive customer experience (Max-Neef, 1992). In most cases, the client will need the building to be; functional, safe, and economical whilst complying with to building regulations and other standards. Wants within the context of construction, however, often refer to the overall aesthetics and design of the building including communications systems, building materials or the interior furnishings. Desires, on the other hand, are more negotiable and refer to the things that the client hopes for. Very often the delivered service quality differs somewhat from the expected service (Taylor and Miyazaki, 1995). As a result, many researchers have highlighted the need to distinguish between customer's expectations (i.e. the needs, wants, and desires) and delivered performance.

THE PINNACLE APPROACH

As a way of assessing and interpreting customer satisfaction, the "Pinnacle Approach" aims to monitor customer satisfaction and address organisational professionalism. The proposed model (shown in figure 2) has been created to become the standard model used by all construction professionals, which accounts for both build and customer experience in order to provide a holistic representation of the actual experience received. The triangle has an existing baseline, which is joined to two sides, one labelled "management"; relating to the organisations management of time, cost, quality and safety, and the other labelled "customer"; relating to the customers expectations and the delivered service based on needs, wants and desires. Both axes close at the top to form a "satisfaction peak".

Methodology

The following equation has been developed by reviewing previous service quality models. The level of satisfaction relating to customer experience is determined by weightings attaching to needs, wants and desires and whether or not the expectations were fully met (100%), partially met (50%) or not met (0%). A theoretical example of customer weightings is shown in table 1. As each customer is unique, the weightings will change to reflect the overall level of importance. However, in this example it is suggested that the "customer" felt that their needs were most important to them (50%), followed by their wants (30%) and their desires (20%).

$$\text{Customer Experience} = \sum Nw\,(NPF) + Ww\,(NPF) + Dw\,(NPF)$$

$$= \sum N0.5\,(1) + W0.3\,(1) + D0.2\,(0) = 0.80\,(80\%)$$

Table 1. Customer Experience Weighting

Customer Weightings		Customer Experience		
		Not Met (0%)	Partially Met (50%)	Fully Met (100%)
Needs	50%	N	P	F ✓
Wants	30%	N	P	F ✓
Desires	20%	N ✓	P	F

* Nw = Needs Weighting Ww = Wants Weighting Dw= Desires Weighting

Similarly, the level of satisfaction delivered relating to the management of the build is determined by weightings attaching to time, cost, quality and safety.

Historical information shows, that in the majority of cases, the build and customer experience will not be equal. As a result, as the baseline moves upwards to join the dots plotted on the axes, the triangle becomes skewed. Shown in figure 2, is an example of a 65% build experience and 80% customer experience. However, should an organisation consistently receive 90% or above for both build and customer

experience, they are deemed to fall within the "golden triangle" as the result of very satisfied customers. "Peak satisfaction", on the other hand, occurs when 100% build and customer experience is achieved. Although such results seem unlikely the peak serves as a striving point for all organisations who aim for "peak satisfaction" and indeed professionalism at every level. The better the overall experience the smaller the triangle becomes and as organisational practices come closer to the "pinnacle", so professionalism will increase creating positive customer satisfaction and business benefit.

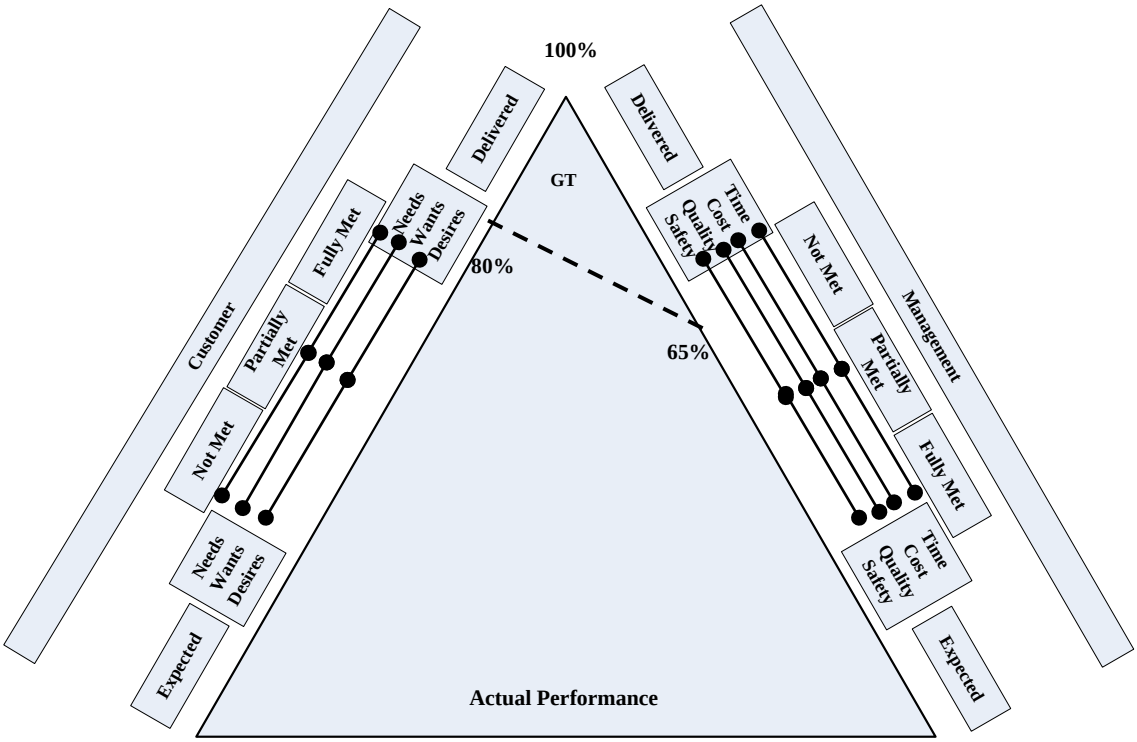

Figure 2. Skewed Pinnacle Approach Triangle

* Customers may assess their overall level of satisfaction by considering the following factors: external influences, perceived service quality offered and/or received, personal needs, past experiences, expected service, perceived service, perceived value, repurchase intention, relative price, value, willingness to buy, ideal standard, expected outcome, negative disconfirmation, satisfaction (attitude), behavioural intentions, perceptions, perceived performance, desires, desires congruency, expectations disconfirmation and overall satisfaction.

* Management may assess the organisations overall performance by considering the following factors: tangibles, reliability, responsiveness, assurance, empathy, team work, employee job fit, technological job fit, perceived control, supervisory control, supervisory control systems, role conflict, role ambiguity, external communications to the consumer, horizontal communication, prosperity to over promise, task standardisation, goal setting, perceptions of feasibility, management commitment to service quality, professional judgement, physical facilities and processes, behavioural aspects, features, comfort, personal attention, reliability, functional service quality, technical service quality, product quality, actual price, marketing research orientation, upward communication, levels of management, word of mouth, company name, marketing strategies, traditional marketing activities, core attributes,

pivotal attributes, translations of perceptions into service quality specifications, management perceptions of the customer's expectations, service delivery (including pre & post contracts) and the service environment peripheral attributes.

CONCLUSIONS

The findings of the research confirm that customer satisfaction forms an integral part of improving business operations and enhancing customer experiences whist creating competitive advantage, increasing revenue and ensuring long term business relations. Although a wide range of models exist which assess customer satisfaction and service quality, this paper has presented two unique models designed for construction use. The factor analysis meta-model has been created which can be used by all construction professionals to monitor customer satisfaction using an "appropriate and atypical" technique. The model can be used to identify the important influences on customer satisfaction, allow organisations to quickly and easily identify areas of weakness and management professionals to prioritise areas for improvement. Additionally, the research describes the use of a "pinnacle approach" by linking the predominant influences of building and service quality in respect to customer satisfaction. As organisational practices come closer to the peak of the triangle, so professionalism will increase creating positive customer satisfaction and business benefit. Although the "pinnacle approach" has been specifically developed for use within the construction industry, the concept is transferable to other industries which aim to monitor and improve customer service and satisfaction. Overall, the paper concludes that both the factor analysis meta-model and "pinnacle approach", when correctly applied, have the potential to add value to the customer satisfaction approaches utilised within the construction industry.

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INSTITUTIONAL BARRIERS IMPEDING PARTNERING IN BELGIAN PUBLIC CONSTRUCTION PROJECTS

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ABSTRACT

The traditional organising method of design, bid, build is proven to be unsuitable to deliver through-life value in construction projects. Implementing through-life value teams, establishing partnering structures which connect business need, design, production, handover and use of a new facility, are increasingly encouraged worldwide. Many researchers reported on measureable successes and some questioned the low level of adoption.
The move to integrated project teams being witnessed elsewhere is not taking place on the same scale in Belgium. Relative to other countries Belgium is not going down this 'partnering' path, although there is clear evidence of growing dissatisfaction and inefficiencies in outcomes in the Belgian construction industry, especially in public construction projects.
Why are partnering or integrated project teams not widely prevalent worldwide? The aspects preventing the adoption of partnering are categorised in cultural barriers, regarding people and their attitude, organisational barriers concerning processes and routines and institutional/industrial barriers. For Belgian construction actors the latter is regarded as critical, because legislation and regulations support, strengthen and, form the cultural and organisational barriers.

Keywords: barriers, Belgium, institutional, partnering, public.

INTRODUCTION

The myriad pressure of drivers as globalisation, international project teams, international client systems, demand for greater efficiency is, in part, bringing about a shift towards through-life value. As the traditional organising method of design, bid, build, with a focus on price and competition offer little incentive for trust and cooperation to emerge (Cheung et al., 2003), this method is proven to be unsuitable to deliver this through-life value in construction projects. Implementing integrated through-life value teams, establishing partnering relationships in which all project actors collaborate to connect business need, design, production, handover and use of a new facility, are increasingly encouraged worldwide. This trend is apparent in countries like the UK (Naoum, 2003), Japan (Chan et al., 2006) and Sweden (Eriksson et al., 2008, 2009) where researchers reported on measureable successes.

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The move to integrated project teams being witnessed elsewhere is not taking place on the same scale in Belgium. Relative to other countries Belgium is not going down this 'partnering' path. Therefore the espoused benefits of integrated, collaborative working are not being experienced. Although there is clear evidence of growing dissatisfaction and inefficiencies in outcomes in the Belgian construction industry, construction participants as well in public and private sectors do not seem to look for alternatives.

Without this move towards proper integration of design, construction and operation functions requiring a move to fully integrated project teams, early supply team involvement, continuous improvement processes, joint commitment and sharing risks, responsibilities and profits best through-life value will never be achieved. Adversarial relationships and disputes will continue to dominate the industry. No mutual trust and commitment will get established.

Although partnering seems to be a suitable alternative to traditional procurement, to achieve through-life value, its low level of adoption should be questioned. Why are partnering or integrated project teams not widely prevalent worldwide? Based on several other researches, Eriksson et al. (2008, 2009) detected three types of barriers preventing the adoption of partnering in the construction industry.

BARRIERS TO PARTNERING

The aspects preventing the adoption of partnering are categorised in cultural barriers, organisational barriers and institutional or industrial barriers.

Cultural aspects regarding people and their attitudes, like conservatism, inflexibility, low commitment, mistrust often constitute a vital barrier to change (Ng et al., 2002), as well as the adversarial culture in the construction sector (Bresnen and Marshall, 2000) with parties trying to achieve individual objectives, rather than working together towards mutual objectives.

The second group of barriers involve organisational aspects. The traditional organisation of construction projects in which distinct packages are allocated individually to different specialists together with the client's competitive tendering habits, hampers the integration of work tasks and actors (Briscoe et al., 2004). These factors are even strengthened through legislation (see next section). Ng et al. (2002) report that relationships become strained if actors have low confidence in each others' competences. Every party involved needs to develop new competences to participate in partnering projects (Eriksson et al., 2008). Exchanging competences among participants in collaborative relationships can be achieved through early contractor procurement and, forward integration in the supply chain.

Competitive pressures and government regulations are examples of the third group, the institutional or industrial barriers that are derived from the organisation's industrial environment, potentially serving as serious barriers to change in general (Eriksson et al. 2008, 2009). Through establishing legislation, the previous barriers are even more supported.

The following section will focus on the latter for public procurement. Which institutional barriers are impeding the adoption of partnering in public sector projects? Legislation influencing public construction/procurement is examined to map the

obstacles to overcome/to challenge in order to implement future organising strategies in public construction projects to achieve through-life value.

INSTITIONAL BARRIERS

Although Eriksson et al. (2008, 2009) identified these institutional/industrial barriers as least critical, Phua (2006) found out that institutional forces far outweigh the importance of economical forces in determining partnering occurrence. A lack of strong institutional partnering norms in the industry largely explains why the implementation of partnering has remained patchy. Organisations are shaped by institutional norms and pressures such that common structures and patterns of collaboration between firms, copied over time, will become 'legitimate' and generally accepted practice (Osborn and Hagedoorn, 1997). Institutional forces that arise from specific regulatory institutions (e.g. laws, regulations) and normative and social norms (e.g. professional conformity, industry and societal expectations) will, to a certain degree influence business decisions and organizational actions. It appears that partnering has not achieved the status of 'proto-institution' where its practices, rules and technologies become so entrenched that firms choosing other practices, rules and technologies will become less competitive (Phua, 2006).

Public procurement legislation (PPL 1993 and PPL 2006)

Public procurement legislation aims to facilitate competition and non-biased procurement decisions. Since public procurement cannot be grounded on trust-based negotiations and prior work experience, these laws are often seen as working against collaborative relationships (Ng et al., 2002; Naoum, 2003).

In the Belgian public procurement legislation as well, the factor competition and awarding on lump sum basis is already launched in article 1 (PPL 1993) and article 5 and 6 (PPL 2006). Together with article 15 and 16 (PPL 1993) renewed in article 24 and 25 (PPL 2006) the selection criterion is described as follows: the lowest or most economically advantageous regular tender will be selected; the emphasis is clearly set on the selection of the lowest tender price. Both the competition culture, in which early procurement of all key actors (supply chain integration) to a project is impossible and the tender price being seen as the only selection criterion, clearly impedes the adoption of partnering in public sector projects.

The new legislation of 2006 together with the royal decrees of 2011, provides through competitive dialogue possibilities, for limited invitation to a few trusted bidders, increasing the chances of lasting relationships in which actors can establish shared values and win-win attitudes, compared to the short term perspective of the open bid procedures (Eriksson et al., 2008). But even there in the few examples existing, price again represents at least 60% of the selection criteria, the other 40% embodies timing and materials used, which are both price-driven. They are not the soft parameters like resources and competences, reputation, collaborative ability, earlier experience of the supplier and shared values, Kadefors et al. (2007) suggested to use. The government urgently has to come up with specific partnering guidelines and policies.

Architects' act (1939)

The use of integrated project teams is also restricted by the monopoly status of the architect in Belgium, including the prohibition of collaborative working between architect and contractor because of the potential conflict of interests that would occur

(article 6 Architects act). This means that the Belgian architect, as an adviser and representative of the client, at all times has to preserve his incompatible relation with the contractor. The argument behind it is, he cannot control and work together with or be paid by the contractor at the same time. Through this act it is clear that the architect and the contractor can never fully collaborate and share gains as it is aimed for by implementing integrated project teams and more particular partnering.

This act of 1939, protecting the title and profession of architects is still in use today. It was modified fourteen times between 1969 and 2009 through establishing new acts and royal decrees. The most prominent was the act Laruelle, which offered architects from 2006 on the opportunity to practice their profession in a limited company, again without any involvement of incompatible professions allowed, i.e. the contractors. This new law also obliges architect to insure their professional indemnity and ten year liability, what was only a deontological requirement for the registration at the Chamber of Architects before. The architect is the only construction professional bound by law to insure his/her indemnity and liability. This results in a deep pocket approach: when disputes arise, consequently the architect is often seen as the party who can best bear the risks. Sharing and insuring the risks in an integrated project team expects more involvement, investment from the client and the contractor, which surely is seen as a barrier.

According to article 4 of the Architects act, Belgian clients are obliged to engage an architect whenever they initiate building activities that require a building permission, which are all projects that involve structural issues. This protection of the architect's function aimed at protecting the public interest (Van Gulijk, 2010). This means that in every construction project an architect is involved and subsequently a design contract is signed, because without a signed agreement between client and architect, the Chamber of Architects will not provide the 'visum', a document necessary to apply for the building permission with the authorities. In that design contract the architect has to make several commitments. They comprise at least (art. 4 Architects act): designing the project, delivering the plans and documents for the building permission, inspecting the execution on site and assisting the client at completion (Uytterhoeven, 2010). Article 21 of the 'Reglement van beroepsplichten' (16th December 1983) add to this duty that an architect can never accept an assignment only for making a design without the duty to control the execution, unless he can assure that another architect is engaged to provide that particular service. Like Egan stated (1998), these formal, rigid, contractual relations need to be replaced by an integrated supply chain system which improves productivity and profits.

A last consequence of this Architect act, but surely not the least, is that for many years now the Belgian architect has been/become the professional in charge in construction projects. It is not a surprise that the study of Black et al. (2000) states that consultants are less convinced of the partnering thought and appear to feel that partnering is simply a fad. According to the study they are less enthusiastic due to fears of loss of control. A change in the architect's attitude will be paramount, which as well is an example of the cultural barriers listed above.

Regulation concerning sustainability and energy efficiency

This legislation is changing at an inimitable tempo in Belgium. Taking on this challenge in team, would avoid overloading the work package of the architect and the incomplete bidding documents. These regulations should be seen as a driver, an

opportunity to implement partnering, not as a barrier, because the effort could be spread among all professionals involved (Post et al., 1994).

Other institutional barriers

Next to regulations, Craft (1991) reports on another barrier. Trade unions or professional bodies mostly have a conservative and defensive culture that inhibits change and encourages maintenance of the status quo. Van der Auwera (2010) aligns this to the conservative Chamber of Architects and their unwillingness to reform, while they are in perfect position to stimulate innovation in building organisation through their architect members.

The deep-rooted practice of using standard contracts may prevent partnering since it brings a formality that stifles good relationships (Barlow et al., 1997). Knowing that system-based trust is ranked as the most important trust factor among clients and consultants, this indicates that they rely strongly on satisfactory contract terms to enhance trust (Wong et al., 2004). At the same time these contracts increase opportunism (Lazar, 2000), since standard contracts are too rigid and do not emphasize collaboration and sharing of responsibilities and risks. Instead, they focus on the individual parties and their responsibilities, thereby driving a distance between them (Eriksson et al., 2008).

To finish alternative dispute resolution like adjudication (Murdoch and Hughes, 2008) is nearly non existing in Belgium. After the formal notice of a default, construction participants are used to bring disputes immediately to court, which obviously results in delays on site and requires extra financial resources (Essex, 1996). If construction parties want to establish partnering in Belgium this is another tradition to remove.

CONCLUSION

In the search for aspects preventing the adoption of partnering, the barriers were categorised in three groups: cultural barriers, regarding people and their attitude, organisational barriers concerning processes and routines and institutional/industrial barriers. For Belgian construction actors the latter was regarded as critical, because institutional barriers like legislation and regulations support, strengthen and, even form the cultural and organisational barriers. Public procurement law and the architects' act are considered as the largest obstacles.

In public procurement legislation, both the competition culture, in which early procurement of all key actors (supply chain integration) to a project is impossible and tender price seen as the only selection criterion, clearly impedes the adoption of partnering in public sector projects. In the few examples existing where more selection criteria are incorporated, price again represents at least 60%, the other 40% most frequently embodies timing and materials used. Both price-driven and are not the soft parameters like resources and competences, reputation, collaborative ability, earlier experience of the supplier and shared values, Kadefors et al. (2007) suggested to use.

The monopoly status of the architect, implied by the Architects' act generates formal, rigid, contractual relations which hamper collaborative incentives. It needs to be replaced by an integrated supply chain system to be able to improve productivity and profits (Egan, 1998). It includes as well the prohibition of collaborative working

between architect and contractor because of the potential conflict of interests that would occur. The architect has to preserve at all times his incompatible relation with the contractor, the argument behind it being, he cannot control and work together with or be paid by the contractor at the same time. Through this act it is clear that the architect and the contractor can never fully collaborate and share gains as is aimed for by implementing integrated project teams and more particular partnering.

Together with conservative professional bodies with defensive cultures, the use of contracts focussing on individual parties and their responsibilities, thereby driving a distance between construction actors and a lack of alternative dispute resolution, the government urgently has to come up with specific partnering guidelines and policies.

To end, the vision of Post and Altman (1994), to see opportunities in certain barriers, is worth investigating in future research. Removing all barriers is not always necessary to innovate/to change, studying barriers meticulously could also result in creating new opportunities.

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IS THERE BALANCE IN BUSINESS PROCESS MANAGEMENT?

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ABSTRACT

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Keywords: five keywords listed reflecting the contents of the paper, please use lower case and alphabetical sequence separated by commas, finishing with full-stop.

INTRODUCTION

The usual methods for boosting performance - process rationalization and automation - haven't yielded the dramatic improvements companies need because the focus has been on software or technology and not on the process itself, and often it is not understood why companies and their employees perform the processes in the first place. In particular, heavy investments in information technology have delivered disappointing results, largely because companies tend to use technology to speed up outdated ways of doing business rather than evaluating and changing the processes or the ways they do business. Business cycles change often and if companies do not stay focused on their processes of how they deliver their goods and services to their customers through these changing cycles they will not survive. They leave the existing processes intact and use computers simply to speed them up (Hammer, 1990).

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But speeding up those processes cannot address their fundamental performance deficiencies and inefficiencies (Hammer, 1990). Many of the management philosophies, approaches, techniques, designs, control measures and organizational structures we use today were created in a business environment that existed long before the advent of the computers. The entire focus was, and still is, on efficiency and control measures. The management buzzwords then and now are still the same; creativity, speed to market, efficiency in production, innovation, total quality management, and great customer service. The idea that technology simply makes our processes better is not supported, it's the process itself aided by computer technologies that determines desired outcomes and prescribed success. Thus the process must be revaluated and reengineered if the dramatic performance increase that are need are ever to be realized.

PROCESS REENGINEERING IN THE BUUSINESS SECTOR

Among the general business audience, however, the usage of reengineering has come to be near the middle of a broad spectrum of uses (Davenport and Short, 1990). So what exactly does reengineering mean? To some, reengineering means any attempt to change how work is done, even incremental change, of small, sub-functional processes. To others, process reengineering means an ambitious and extreme organizational transformation, where major organizational changes occur simultaneously in philosophy, strategy, approach, process, culture, information systems, and all other organizational arenas. "A 1994 survey of North American and European companies found that reengineering activity was quite prevalent at 69% and 75% respectfully, and at least one project under way. Of those not then doing reengineering, half were planning or discussing projects. In both Europe and North America, companies had more than three reengineering initiatives completed or under way on average. As reasons, they cited more demanding customers, increased competition, and rising cost as the primary drivers. In the same survey, companies were asked what processes they had addressed through reengineering. The most popular processes in North America were customer service (25% of respondents), order fulfillment (16 %), manufacturing processes (15%) and customer acquisition (Davenport and Short 1990)." So what happens to companies as they begin to reengineer their entire organizational processes? Many companies do take a "clean-sheet" approach to designing a process or starting from scratch with a new clean slate hoping to instill positive real change that will transform the organization and all its elements. The creative design teams attempt to imagine "the best of all processes", without regard to the existing constraints of people, information systems or company organizational factors such as philosophy, culture, management style and approach. Therefore there should be no surprise that the new process designs that many firms create are quite radical, with ambitious plans for new technologies, new skills, and new organizational structures (Davenport and Short, 1990). However, only a fraction of companies attain their change goals typically due to problems with implementation, due to time frames, and due to costs and personalities within the organization (Davenport and Short,1990).

PROCESS IMPORTANCE IN CONSTRUCTION

The construction management process is a necessary procedure in construction companies' execution of their business (Cheng and Tsai, 2003). A construction company that employs an inefficient and ineffective process management protocol and process structure will have a profound impact on its project performance,

financial performance and overall company success. However, most construction business owners today are not able to properly identify and determine a correct process because they are too far removed from the day to day operations and requirements of project management and current technologies associated with the process. Therefore, these current business owners fail to establish effective systems or processes or even be able to understand whether they are reasonable and effective. These problems result in a redundancy of business operations and are a waste of valuable human and time resources (Cheng and Tsai, 2003). They can render management ineffective to the degree that those individuals may not know how to improve their predicament (Cheng & Tsai, 2003). If management is better able to evaluate the existing management process and address deficiencies before the implementation of automation or the establishment of a standard operation process, the likelihood of computerization's success will be greatly increased (Cheng & Tsai, 2003). Therefore the process itself and its flow through the organization must be evaluated for efficiency, effectiveness and value. One way to determine this is to select a process that may need evaluating or reengineering and create a matrix of business functions and their link to human functions within the organizational structure.

WHAT IS A BUSINESS PROCESS?

A business process is a collection of related, structured activities or tasks that produce a specific service or product (Toor and Dhir, 2011). "There are three main types of business processes:

1) Management processes; the processes that govern the operation of a system. Typical management processes include "corporate governance" and "strategic management".
2) The next business process is operational processes; processes that constitute the core business and create the primary value stream. Typical operational processes are purchasing, manufacturing, marketing and sales.
3) The third and last business process is supporting processes; which support the core processes. Examples include accounting, recruitment, and technical support. The analysis of these business processes typically includes the mapping of processes and sub-processes down to activity level (Toor and Dhir, 2011)."

A business process model is a model of one or more business processes, which defines the ways in which operations are carried out to accomplish the intended objectives of an organization. (Toor and Dhir, 2011) One of the benefits of business process modeling is the actual function of modeling and simulation functionality that allows for pre-execution of "what –if" scenarios that then leads to post-execution optimization based on the analysis of actual "as-performed" metrics as noted in the business function process matrix. The key to business process reengineering is for organizations to look at their business processes from a "clean slate" perspective and determine how they can best construct these processes to improve how they conduct business (Toor and Dhir, 2011).

A major continuing stimulus for reengineering has been the emerging innovation and user friendly development of sophisticated information systems, networks and touch pad technology that enable us to manage numerous processes simultaneously, with greater ease than in years past. Leading construction companies are becoming bolder

and more aggressive in using this technology to support and maintain innovative business processes, win strategies, and a competitive advantage in their market place rather than trying to refine ways of doing the same old project management processes. It is a holistic management approach that promotes business effectiveness and efficiency while striving for innovations, flexibility, and integration with technology (Toor and Dhir, 2011). As organizations strive for attainment of their objectives, business process management attempts to continuously improve processes – the process to define, measure and improve your processes – a "process optimization" process (Toor and Dhir, 2011).

WHAT ARE THE CRITERIA FOR BUSINESS PROCESS MANAGEMENT?

What are the criteria for business process management? It entails several approaches: documenting the process to obtain an understanding of how work flows through the process, the assignment of process ownership in order to establish managerial accountability, manage the process to optimize some measure of process performance, and improving the process to enhance product quality or measure to process performance (Gulledge and Sommer, 2002). Business process management is actually an event driven process wherein one engages in the planning of an event and manages an event from start to finish and its interactions with other simultaneous events. To understand the events that occur or should occur, an evaluation process must take place.

The evaluation is undertaken to inform decisions, clarify options, reduce uncertainties, and provide information about programs, policies, and processes, all within contextual boundaries of time, place, values, and politics (Patton, 1990). This information is used to make decisions that reduce uncertainties, improve effectiveness and identify reasons for success or failure (Vakola and Rezgui, 2000). Evaluation gives reliable, independent assessment of the results of continuing activities and information on which decisions can be based (Vakola and Rezgui, 2000). Managers need to understand the effects of their activities in order to look for alternative approaches and test their results (Caulley, 1993). M. Scriven introduced two different types of evaluation in his book *The Methodology of Evaluation*, the first being "formative evaluation" which is based on the collection of information that can be used primarily for program development and improvement, and the other is "summative evaluation" whose primary purpose is to make an overall judgment about the effectiveness of a given program (Scriven, 1967). According to Sherwood-Smith (1994), formative evaluation in business process reengineering aims at impacting, in an incremental way, decision making throughout the reengineering process, whereas summative evaluation is used to validate or reject the final outcomes. Evaluation is a problem solving process or a process that provides information for decision making (Wholey, 1994). Additionally, evaluation relates to knowledge construction and capacity building (Segone, 1998). For example, the use of "lessons learned" at the end of a project is a critical success factor in the construction industry (Vakola and Rezgui, 2000). Evaluation also facilitates the process of knowledge transferability to similar situations (Vakola and Rezgui, 2000). Can the processes be duplicated by others and have the same outcome? Lesson are transformed into knowledge when they are analyzed, systematized, disseminated and internalized within an organization through evaluation processes (Segone, 1998).

As reengineering activities focus on outdated and inefficient processes in order to make changes that achieve the greatest impact, prior to execution, the present process must be reviewed to locate process barriers in order to ensure their targeting in process redesign (Cheng, Tsai and Lai, 2009). Process value, used to evaluate process performance, can be viewed from either of the following two perspectives: efficiency per unit of cost or efficiency per unit of time (Cheng, Tsai and Lai, 2009). Time is an important factor that impacts the overall cost in providing goods and services in that the longer the process takes to accomplish, the higher the financial price demand, therefore the less competitive a company can be. Although evaluation can facilitate the change process, and is a major asset in the business process reengineering effort, there are many factors that can potentially obstruct this process; fear of being blamed, fear of being shammed, fear of uncertainty, fear of politics, and fear that the evaluation will be unfair (Patton, 1990). "Process orientation has one fundamental problem: requiring organizations to formalize their business processes down to the task-level details required by BPM (Business Process Management) technology. But that rationalistic/mechanical approach is often infeasible or harmful to organizational behavior. First there is a trade-off between responsiveness and formalization. High formalization makes organizations less responsive to turbulent environments. Low formalization naturally increases responsiveness, but challenges the capacity of the BPM systems to effectively coordinate business activities. We also find a trade-off between detail and ambiguity (Antunes and Mourao, 2011)." Most service-oriented organizations deal with great levels of informality, variability and ambiguity (Saastamoinen, 1995). Therefore many work processes must be kept at very generic and often vague levels of detail (Antunes and Mourao, 2011). On the contrary, BPM systems often require detailed specifications about what, how, when, who and where activities should be executed (Antunes and Mourao, 2011). Besides these relatively confined issues we should also take a broader view of the organizational forces shaping BPM technology (Antuens and Mourao, 2011). Several researchers observed that computerization has been increasing and organizations are becoming more dependent on computer technology (Hollnagel and Woods, 2005). All along with this increasing dependency we find out that organizations and computing technology have become more complex, adopting new transformation processes, higher temporal demands, wider distribution and span of control, increased skills level and more intensive decision-making abilities (Hatch 2006). The consequence of this trend is that organizations have become more prone to hazards (Perrow, 1994). The transformational process mainly represents the application of conducted operational analysis and process modeling. The primary purpose of operational analysis is to define a processes operational category and hierarchical structure. Process modeling is used to provide a comprehensive explanation of the relationship between operations (Cheng, Tsai and Lai, 2009).

In conclusion, business process management is actually an event driven process wherein we engage in the planning of an event and we manage an event from start to finish and their interactions with other simultaneous events. It is a method for boosting performance that requires constant evaluation and does not simply get better by adding technology to it in order to produce events faster. Therefore, processes must be evaluated and reengineered if we are to transform our organizations, change business strategies, and culture. The evaluation and reengineering of our processes is due to more demanding clients, order fulfillment, manufacturing ability and speed to distribution and customer acquisition. It drives every aspect of our business and how

the business operates and our clients interface with it. It is the currency by which we exchange with our customers for goods and services. The analysis of our business processes typically involves mapping of our processes and sub-processes down to the activity level then documenting it for evaluation. A business process model can used to help better understand and define the ways in which we operate that can lead to process optimization. Evaluation is a problem solving process that provides information to enable us to make better decisions. Therefore the process itself and its flow through the organization must be evaluated for efficiency, effectiveness and value. In all the literature reviewed, there was no mention of "balance in process management" meaning how to identify and quantify the process to determine if it is too much or too little for the organizational structure and the human and time resources to effectively and efficiently execute. Therefore, more research and study is required to truly gain an understanding of the balance in process management and its effects on the organization and its ability to successfully meet the ever changing competitive business climate in which we work.

However, the authors have taken the liberty of evaluating a process in the organization in which they work to evaluate the overall process and work flow of how an estimate of a project is performed and hereby provide an approach to consider in evaluating the balance of processes within any organization (Figure 1). It begins by looking at the work flow process of estimating a project and the simple steps required to arrive at a complete project budget or GMP, guaranteed maximum price budget.

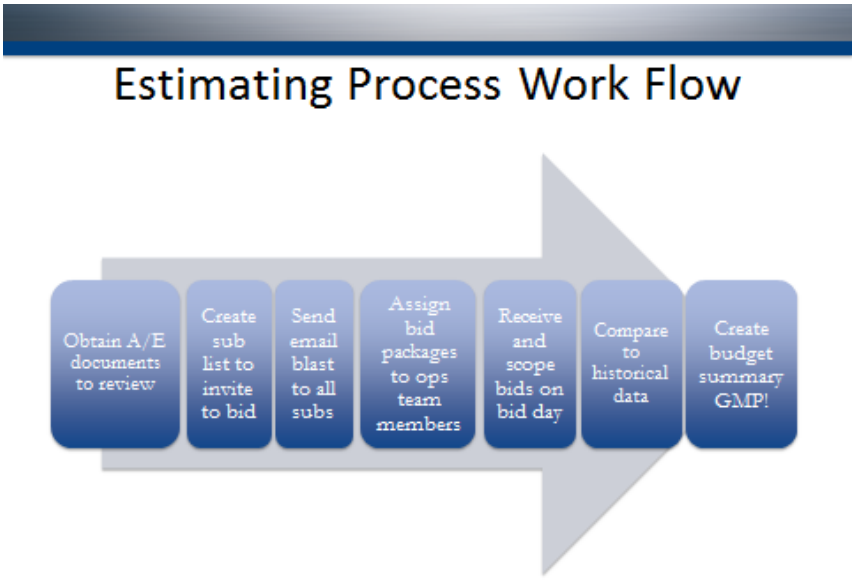

Figure 1. Estimating Process Work Flow

In order to understand the graph above and how to create a budget summary or GMP, one must first comprehend the desired outcome from the process; the desired outcome is a complete and competitive, line item budget summary, with good scope coverage in every trade. Once it is known what the desired outcome is we can start the process with the end in mind. Each step must be evaluated as to its importance in the process, who does it, how long does it take them to complete, and how many people does it take to complete the task, does it add value to the process or budget and is the

information produced accurate and complete? Notice in the table below the correlation between the tasks and the scoring criteria. The scoring criteria will help us see if our process work flow is balanced.

Table 1. Process Flow Evaluation

			Estimating Process - Work Flow				
Criteria	Obtain A/E Documents	Create sub contractor list to invite to bid	Send email blast to all subs	Assign bid packages	Receive and scope bids	Compare to historical data	Create budget summary / GMP
Who Does it	1	5	1	5	5	5	5
How long it takes	5	5	5	3	5	3	5
Number of people	5	2	5	5	5	3	2
Does it add value?	5	5	5	5	5	5	5
Accuracy	5	5	5	5	5	5	5
Completeness	5	5	5	5	5	5	5
TOTALS	**26**	**27**	**26**	**28**	**30**	**26**	**27**
* score on a scale of 0 - 5 of level of importance with 5 being the highest or most important							

CONCLUSION

Process engineering requires have the proper amount of structure to afford maximum efficiency and governance, but at the same time must allow for critical thought, day-to-day flexibility for execution, and not restrict value-based behavior. The body of literature seeking to propose ways to measure process balance as having either too much structure and rigidity, too little, or just enough is nearly non-existent. A full evaluation must include organizational, personnel, and process components. This field of study currently affords much room for discovery.

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MULTI-FIRM FEEDBACK AS A BENCHMARKING TOOL –THE CASE OF FINLAND

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ABSTRACT

Multi-firm project feedback supports the efforts of construction companies to establish industry benchmarks and to improve performance. Feedback indicates project success and thus complements traditional performance measures. The construction industry needs effective methods for gathering and utilizing information that can raise awareness of and steer reactions to operational problems and conflicts. This paper describes the features and benefits of a multidirectional project feedback system and the accumulated results for the Finnish construction industry. The multi-directional feedback system enables project participants to evaluate one another's performances at different stages of a project and therefore enables versatile benchmark comparisons between projects and between companies. The main performance factors, including project management, staff, collaboration, and goal accomplishment, were analyzed for project consultants, main contractors, subcontractors, and architects/designers. The analysis is based on approximately 800 feedback entries, representing 788 projects, over a 5-year period during which the feedback system was used. The project feedback data provide both a national-level overview of the performance of the Finnish construction industry and a base-level benchmark for various parties involved in this industry.

Keywords: client satisfaction, feedback, performance improvement, performance measurement, project participants' satisfaction.

INTRODUCTION

Growing competitive pressures and the introduction of initiatives to improve productivity, quality and efficiency are leading many construction organizations to rethink their construction processes. The complex nature of the construction process, changes in project organization, the uniqueness of each project and the variability of the objectives of the parties involved complicate evaluations of project outcomes and emphasize the need for effective and efficient evaluation systems (Kumaraswamy and Thorpe 1995).

The aforementioned factors have raised the awareness of performance measurement strategies (benchmarking) among the majority of construction organizations

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(Mohammed 1996). To improve performance and management, companies should use multiple tools to measure their ability to develop and monitor products and services (Garvin 2001). Feedback from project clients and participants can be used as a performance measurement tool during the construction process and collaborations.

Among the most common benchmarks used in the construction industry are key performance indicators (KPIs). KPIs are performance standards that focus on factors critical to the success of an organization or project. With the help of KPIs, companies can identify the best practices for developing their operations (CII 2004). Recently, soft KPIs such as customer satisfaction and project participants´ satisfaction have been investigated. These indicators complement traditional key performance indicators such as cost, schedule and quality. Thus, a holistic view of performance measurements in the realm of multifaceted construction projects has been acknowledged (Dainty et al. 2003; Leung et al. 2004; Nzekwe-Excel 2012; Lehtiranta et al. 2012).

However, the industry seems reluctant to adopt benchmarking, mostly due to the difficulty of collecting and utilizing relevant data (Mohamed 1996). In addition, current management frameworks and tools do not comprehensively correspond to the characteristics of project networks (El-Sheikh and Pryke 2010) or the multi-faceted substance of project success (Jugdev and Moller 2006). The challenge to industry is then to develop and adapt effective methods for gathering and utilizing information to make organizations aware of operational problems and conflicts. In Finland, a solution that responds to the challenges of multi-organizational project feedback and industry-wide benchmarking has been proposed and tested. As a common system for parties in the industry, the project feedback system promotes performance improvement, customer orientation and collaboration.

This paper introduces the features and benefits of a multi-firm project feedback system, which has been used to measure the mutual performance of project participants in the Finnish construction market since the year 2007. The accumulated project performance evaluation results, which are based on 5 years of use and 800 projects in the Finnish construction industry, are introduced and discussed.

MULTI-FIRM FEEDBACK AND BENCHMARKING

Mohamed (1996) described three types of benchmarking: 1) internal benchmarking, in which a construction organization attempts to identify internal areas of improvement by comparing its business operations with those of its competitors, thereby establishing new targets; 2) project benchmarking, in which a construction organization assesses the performance of its projects to meet customer requirements, measure productivity rates, and validate and maintain its databases; and 3) external benchmarking, in which the industry as a whole attempts to increase its productivity by applying tools and techniques that can be used by other industries. Benchmarking solutions can encompass any combination of these types. The keys to benchmarking in the construction industry are tailoring solutions to specific projects and multi-organizational working cultures and efficiently interpreting data to improve businesses, firms, and the industry as a whole.

Project feedback is a rich source of data for benchmarking. A previous analysis of industry-wide benchmarking results showed that the satisfaction of a participant with the performance of other participants reflects the success of a project (Lehtiranta et al. 2012). This information can then be used in performance measurements and to inform

early reactions during a project. Another report demonstrated that benchmarking results can be used to compare satisfaction levels with various performance components in different procurement methods (Lehtiranta et al. 2011). The perceptions of the owners, project consultants, designers and contractors of the quality of their relationships have been shown to vary significantly, even within the two directions of feedback in one relationship (Lehtiranta et al. 2011).

Significant differences are apparent in the performance measurements of different project types. According to a recent study (Kärnä et al. 2011), infra-project feedback differs from that of other project types, particularly in the perceptions of clients and designers of a consultant's performance and the consultant's evaluation of the contractor's activities, which vary for all three project types. This result reinforces the theory of differences between various types of construction projects, and research and practical development work should focus on the special features of each project type across the entire field of construction.

From the benchmarking perspective, project feedback has two main strengths. Initially, it can focus on an organization's core areas of business to help achieve the greatest added value for any improvement strategy. Second, after determining how a particular production processes compares to others, it can focus on investigating how those with superior performances achieve their performance rates (Kärnä 2009). Project feedback is also a management tool, rooted in the business environment, that can be used to identify changes needed in production processes to improve performance. In brief, it involves analyzing an existing situation, identifying and measuring factors critical to the success of a production process, comparing them with the success factors of other companies, analyzing the results and implementing an action plan to improve performance.

Multi-organizational involvement in project feedback and benchmarking solutions in the construction industry is a natural requirement for several reasons. Construction project success depends on the ability of multiple firms to work together satisfactorily (Lehtiranta et al. 2012) and to manage risks and learning (Cherns and Bryant 1984). The project organization can be described as a *rendezvous,* in which the participants` abilities to create value for one another and the project as a whole are key elements of success. Therefore, project feedback should cover the most important parties in the supply chain and be bi-directional. Feedback should be properly used to provide rich information for risk management and learning both during and after a project.

Typically, project participants evaluate projects from their individual perspectives and use their own criteria to measure success. To attain project goals, a systematic evaluation of organizational performance is required to provide feedback and thereby guide the behavior of participants (Liu and Walker 1998). Because the performance of each participant in a construction project is interdependent, the mutual performance of project participants must be evaluated as an indicator of the ability of participants to provide value for one another.

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THE CASE OF FINLAND – MULTI-FIRM BENCHMARKING TOOL

Development of the tool

The basic version of the project feedback system for the Finnish construction industry was developed between 2005 and 2008 as part of a joint project between the University of Technology, Construction Quality Association RALA and several industry and association partners. RALA operates the system as a joint association that represents clients, contractors, and consultants. Its aim is to improve the prerequisites of construction quality by using certificates of competence, certificates of quality systems, and a project feedback system for clients and construction companies.

During development, the following requirements and system properties were determined to be essential.

- The system should cover the entire industry and use a versatile Web interface
- The central participants of the project should be involved in the system
- It should be possible to give and receive feedback throughout the various stages of a project and to utilize the feedback during a project
- It should enable multipurpose benchmark comparisons
- It should be able to be adapted to different projects and forms of implementation

Main features of the tool

The basis of the feedback system is standard evaluation, in which the main participants evaluate one another's performances. The system identifies five alternative roles for participants: client, project manager/consultant, architect/designer, main contractor, and sub-contractor. Any project participant can sign up as the master user of the feedback system and then invite others to join. The multi-directional network of feedback flows in the system is illustrated in Figure 1.

The evaluation consists of 15 different electronic questionnaires, which are specific to each evaluation flow, such as client evaluations of a main contractor. The questionnaires can be adapted to fit the needs of a project. Feedback related to the operations of other project participants is provided after participants respond to statements about performance on a 5-point Likert scale, where 1 and 5 represent very low and very high satisfaction levels, respectively. Specific questions depend on the flow of feedback, and the common evaluation topics are:

- Project management
- Collaboration
- Staff
- Goal accomplishment

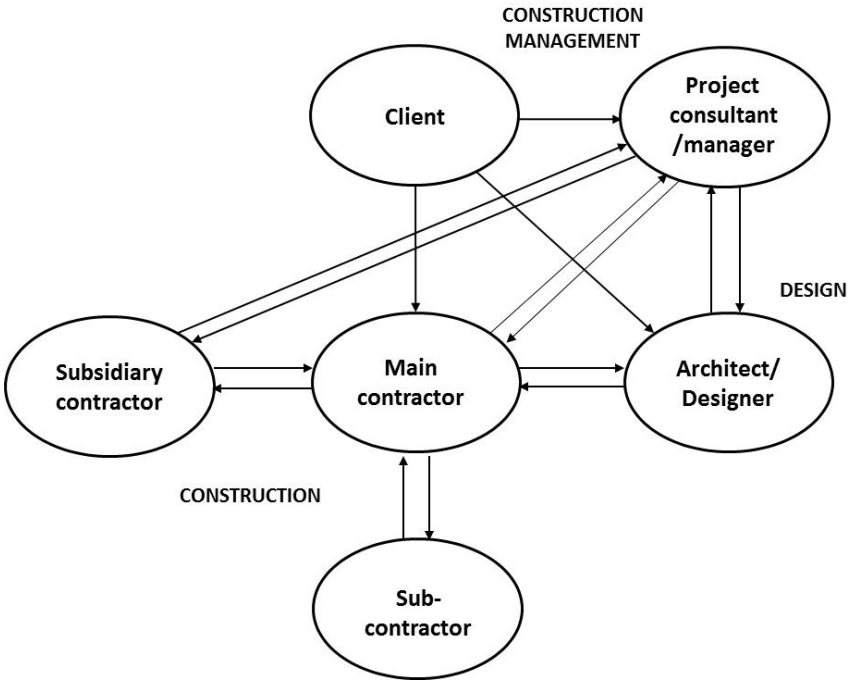

Figure 1. The multi-directional network of feedback flows in the feedback system.

Reporting and benchmarks

The feedback system offers clear, real-time benchmarking reports, which can be tailored to a company's products and processes. By comparing various background variables, a company can compare its performance with that of similar companies in the market.

Figure 2. Illustrative dashboard of a company's benchmarking results based on its project portfolio.

THE CASE OF FINLAND – MULTI-FIRM BENCHMARKING RESULTS

The project feedback system has accumulated 3191 performance evaluation results, representing 788 projects over a period of 5 years. The multi-directional evaluation results are summarized in Table 1 by main categories. Values are feedback flow averages on a 5-point Likert scale, where 1 and 5 represent very low and very high satisfaction levels, respectively. The values in the table form industry-wide benchmarking results, which enable individual companies to compare performances. Higher values indicate and showcase a competitive advantage for the specific factors.

Table 1. The national benchmarks for clients, project managers, main contractors, designers, and sub-contractors in the Finnish construction industry. Based on multi-directional evaluation results.

Evaluator		Project manager / consultant	Main contractor	Architect / designer	Sub-contractor
Client	→	PM (3.8) CO (4.0) S (4.0) G (3.8) TOT (3.9) n=121	PM (4.0) CO (4.2) S (4.1) TOT (4.1) n=620	PM (3.7) CO (3.9) S (3.9) TOT (3.8) n=123	N/A
Project manager / consultant	→	N/A	PM (3.9) CO (4.1) S (4.1) E (4.1) G (4.0) TOT (4.0) n=941	PM (3.7) CO (3.8) S (3.8) G (3.7) TOT (3.8) n=215	N/A
Main contractor	→	PM (3.9) CO (4.3) S (4.3) TOT (4.1) n=282	N/A	PM (3.4) CO (3.8) S (3.6) G (3.4) TOT (3.6) n=211	PM (3.7) CO (4.0) S (4.0) G (3.9) TOT (3.9) n=191
Architect / designer	→	PM (3.9) CO (4.0) TOT (4.0) n=163	PM (3.9) CO (4.0) S (4.0) TOT (4.0) n=238	N/A	N/A
Sub-contractor	→	N/A	PM (3.9) CO (3.9) S (4.0) TOT (3.9) n=113	N/A	N/A
Areas of evaluation		PM=Project management E = Environment	CO=Collaboration TOT=Overall satisfaction	S=Staff	G= Project goals N/A= not available for evaluation

The results show that the general levels of performance evaluations for project participants in the Finnish construction industry are high, as represented by a score

just under or above 4. Although main contractors typically receive some of the highest evaluations and designers receive some of the lowest, the differences are minimal in this aggregate benchmark. The project management performance of the participants can be identified as a factor yielding somewhat lower evaluations than the other factors for a company. Conversely, staff members and their ability to collaborate are generally highly evaluated.

CONCLUSIONS

Benchmarking is a tool that companies can use to continuously improve their performance. In the construction industry, which is project based, multi-firm project feedback can and should be used to identify participants' levels of performance and development needs. As part of the complex and dynamic construction industry, multi-directional project feedback responds to the needs of performance measurements and corresponds to wider perceptions of project success, including satisfaction with the process. Project feedback can be used on several levels: to detect performance problems and identify improvements during a project for the purpose of risk management; to identify improvement needs after a project for the purpose of learning; to analyze project portfolios for the purpose of business improvement; and to accumulate results in a feedback database for the purpose of industry analysis.

In this paper, a multi-firm benchmarking tool and national benchmark levels for the main parties in the Finnish construction industry were introduced based on seven years of research and five years of multi-directional performance measurements. In Finland, multi-firm benchmarking supports the performance of consultants, main contractors, architects/designers, and sub-contractors of a construction project, aids with client orientation, and contributes to collaboration. Companies that exceed the national benchmarks have a competitive advantage.

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PRE-DEPARTURE AND POST ARRIVAL CROSS-CULTURAL TRAINING FOR AUSTRALIAN PROJECT MANAGERS WORKING IN THE UAE

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ABSTRACT

Cross-cultural training at different times of the expatriate's overseas assignment is not only useful but it is critical to the expatriate's success overseas. If western cooperation's such as Australian international companies are to provide expatriates with cross-cultural training companies could reduce or even prevent expatriate failure. This research was based on six case studies, which were all Australian international companies that also operate in the Middle East. The method used was semi-structured interviews. If expatriates are to be successful in the United Arab Emirates (UAE) they need to be prepared with appropriate, adequate and up-to date cross-cultural training. For the cross-cultural training to be most effective it needs to be provided at the three most critical stages; pre-departure, on-site and have a repetition stage once the expatriates have been in the new host country for a few months. The reason for having three distinct stages of cross-cultural training is because expatriates will have to deal with different issues at different times of their overseas assignment, this way the training will be most relevant and effective for the expatriates. This research points out that the most beneficial cross-cultural training is training that is offered at different stages/times of the expatriate's overseas assignment.

Keywords: Australian project managers, Cross-cultural training, United Arab Emirates (UAE) and pre-departure, on-site and repetition stages.

INTRODUCTION

According to researchers such as Foster (2000) and Caligiuri, Phillips, Lazarova, Tarique and Bürgi (2001) it has come to the attention of companies that cross-cultural training is critical if their expatriates are to be successful in their overseas postings.

As to date there is no one definition that constitutes expatriate 'failure'. An expatriate is not only considered to have failed if they return home prematurely but also if they continue to stay in the host country but they damage business relationships and delayed productivity only to name a few (Bennet, Aston and Colquhoun, 2000).

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Companies can lose up to a quarter of a million dollars for every failed expatriate (Morris and Robie, 2000). There is also the non-financial effect of failure. These effects include loss of business opportunities and damage to the company's reputation. There are also psychological issues associated with failure. The expatriate will, most likely, have lower self-confidence and damaged self-esteem.

As pointed out earlier, there are many reasons for expatriates failure and in many cases it is not the technical incompetence of the expatriate but more numerous under laying causes. Such as culture shock, where the expatriate cannot adjust and adapt to the physical, emotional and environmental cultural differences. The expatriate may not have personality skills for cross-cultural interaction which would cause the expatriate to have adjustment difficulties (Tung, 1981; Baumgarten, 1995; Bhagat and Prien, 1996). Hence, cross-cultural training is the key to help expatriates to adjust and adapt to a new culture faster and more effective.

Despite the evidence that with appropriate and sufficient cross-cultural training expatriates are more likely to succeed many companies is still not offering cross-cultural training. Bhagat et al., (1996) estimated that about 30% of the companies offer some type of cross-cultural preparation; most of those training sessions are in fact only 1 day briefing sessions.

There are many reasons why companies have been reluctant to offer cross-cultural training; some of those reasons are that there is not enough time for training, since the time between selection and departure is short. As well as, the cost associated with offering cross-cultural training is high. Yet, there are many companies that choose an expatriate based on their technical competence and they believe that expatriates who operate well at home will be effective and successful regardless of location (Kealey and Protheroe, 1996; Selmer et al., 1998; Morris et al., 2001).

However, companies fail to realise that organisations are becoming more diverse, business dealings continue to cross international boundaries and according to researchers such as Littrell et al., (2006:363) "multicultural training has expended beyond the arena of expatriate employees".

Back in 1982 Church proposed the U curve adjustment theory to explain why cross-cultural training can help expatriates adjust to a new and unfamiliar environment. According to Church (1982) adjustment is a function of time and that is what the U curve of adjustment theory demonstrates. For example, in the beginning stages of the overseas assignment the expatriate is excited and optimistic but as the assignment progresses culture shock kicks in and there is a drop in the level of adjustment and this can be very frustrating to the expatriate. However, if the expatriate has received appropriate and adequate cross-cultural training that individual will be able to recover, deal and adjust better to the new environment. Hence the U illustrates that expatriates will have different experiences within the assignment depending on the time when period. There for cross-cultural training should not be one-off event, but it is a process and it could be tailored to the period of adjustment the expatriate is at (Church, 1982; Selmer et al., 1998).

In fact Selmer et al., (1998) proposes that cross-cultural training should be structured in a way that would match up to the adjustment stage that the expatriate is at. The reason being that the training provided has a different impact based on the expatriate's psychological receptivity to the new culture and the phase of the assignment.

The Purpose of Cross-cultural Training

The whole point of cross-cultural training is to prepare expatriates for their overseas assignment so that the expatriates have a higher chance of success (Black, et al., 1990; Baumgarten, 1995; Forster, 2000).

According to researchers such as Baumgarten (1995) and Bennet et al., (2000) cross-cultural training should provide expatriates with knowledge, skills and abilities which can unable those individuals to adjust more quickly and efficiently to the new environment and to be more effective in business dealings. Additionally, cross-cultural training aims to equip the expatriates with knowledge required to understand the host national's behaviour without judging it and to adapt to it.

Cushner and Brislin (1999) propose four goals that cross-cultural training should consist of. Those goals are:

1. To help expatriates overcome obstacles that my limit them to perform at their full potential while on the overseas assignment.
2. Provide them with appropriate tools which can be used to build relationships with host nationals
3. To be able to successfully complete work related tasks
4. Teach them skills which will help them to deal with stress more effectively

Cross-cultural training that has those four goals imbedded in it will help expatriate's in developing the necessary skills that are necessary for a faster and more efficient adjustment to the host nation.

According to literature in the last past 30 years there have been wast amounts of literature looking at the effectiveness of cross-cultural training. Researchers such as Littrell, Salas, Hess, Paley and Riedel (2006) came to the conclusion that cross-cultural training is important. In fact they believed that cross-cultural training can facilitate success on expatriate assignments effectively.

Cross-cultural training is very diverse and useful not only at preparing expatriates for overseas assignments but also for training domestic employees in how to work with multicultural teams. As well as, it can help domestic mangers in improving cross-cultural avidness of domestic workers so that they can interact with individuals from diverse cultural backgrounds (Priest, Burke, Salas, Littrell, Hess, and Riedel, 2006).

Many companies have realised that cross-cultural training is vital for the success of their mangers, which positively reflects on the company's as well (Foster, 2000; Caligiuri, et al., 2001).

Effectives of Cross-cultural Training

According to Selmer et al., (1998) studies conducted on the effectiveness of cross-cultural training point out that cross-cultural training improves expatriate performance on an overseas assignment. Calgiuri et al., (2001) believe that since cross-cultural training helps expatriated adjust to a foreign culture faster that in turn it has a positive effect on the overseas assignment too, the expatriates tend to be more successful. Cross-cultural adjustment is positively related to performance and it minimises early return rates (Deshpande and Viswesvaran, 1992). Kealey et al., (1996) also found support for the viewpoint that cross-cultural training promotes and enhances skill development.

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Many researchers in the area of cross-cultural training have proposed three categories of skills that expatriate need to possess in order to be successful in the new culture.

Those skills are:

1. Self maintenance skills,
2. Interpersonal skills and
3. Cognitive skills

Deshpande et al., (1992) believe that there is a positive link between those three skill sets and cross-cultural training. In particular, cross-cultural training is positively linked to self-development, the interpersonal skills help expatriates establish interpersonal relationships with the host country nationals and the cognitive skills help develop and nature that relationship.

Black et al., (1990) conducted a meta-analysis of 29 studies which dealt with intercultural training and the results reviled that cross-cultural training is positively linked with a feeling of overall well-being and development of self-confidence. The research also reviled that cross-cultural training had an overall positive effect on interpersonal skill and it was also positively linked to cognitive skills development. In addition, Morris et al., (2001) too did a meta-analysis which reviled that cross-cultural training and expatriate performance are positively related. Hence, the results from those two meta-analysis indicate that cross-cultural training is an effective and useful tool which can facilitate expatriate success.

RESEARCH METHODOLOGY

This research was based on semi-structured interviews. It was started off by selecting 6 case studies, which are all Australian international companies that also operate in the Middle East. First of all the researcher had to research Australian international companies which also operate in the UAE. After the potential companies have been selected the researcher emailed the company's directors and CEOs. The emails that were sent out introduced the researcher and the research and it asked if the individuals that have been emailed would be willing to participate in the study. The emails were received well and most companies were willing to be part of the research.

In some cases the directors and CEOs were the ones interviewed and in other cases the directors and CEOs recommended employees who were best suitable to answer the questions asked as accurate as possible. The snowballing technique was used to extend the sample, this involved asking each interviewee if there is anyone they know off who would be useful for this research, so that the researcher could interview those individual too (Green, Kao and Larsen, 2010).

Once the interviews were transcribed and analysed any area that needed more information or explanation was collected by contacting the participants by email and asking them the relevant questions. This provided a clear statement of the answers and sound documentation for each study.

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FINDINGS

Any cross-cultural program should focus exclusively on the UAE culture, religion, and on how to practice project management in the UAE. This program would have to cover laws in the UAE, leadership and ethics. Emiratis take business personally, so it makes sense to learn as much as possible about the host country's culture in order to be able to avoid misunderstandings and conflict. This research has uncovered three stages of expatriate training; the pre-departure stage, on-site stage and the repetition stage.

Once the cases studies have been analysed, three stages of cross-cultural training emerged. The results will be represented in three different stages; the pre-departure stage, the on-site stage, the repetition stage.

The Pre-departure Stage

The literature strongly advises that cross-cultural training should be provided to expatriates before they are sent overseas to work. Adequate and appropriate cross cultural training will prepare expatriates to deal better with the new and unfamiliar environment. Additionally, proper pre-departure preparation will give the expatriates an idea of what to expect in the new location to reduce the effects of culture shock.

This first stage was named "the pre-departure stage" and this stage is an introduction to the new culture and society.

The training at this initial stage should cover; geography, some history, an introduction to the religion Islam, basic Arabic, a summary of Arabic body language, work place communication culture and lifestyle. Additional, Arabic mannerisms and cultural awareness of specific items that could easily offend the Muslims should also be included. These issues are given in more detail below.

Cultural as well as business etiquette needs to be learned before starting to do business in the UAE. The information provided must be relevant and useful. Most of the challenges are due to the lack of knowledge on how things are done in the UAE compared to Australia. Those mental challenges could be avoided or minimised with appropriate training and preparation of expatriates. A social network and access to support groups would be helpful as well. The new expatriates can help themselves by talking to other expats currently living and working in the country which would help manage expectations and prepare them for their work.

Expatriates need to be provided with all the relevant and up-to-date information in order to be able to make an informed decision on if he/she wants to work and live in the UAE before they leave their home base.

The On-site Stage

The next stage should commence once the expatriates are in the country and "on-site". Cross-cultural training can help expatriates to better understand the culture, customs and work ethics of their host country. The on-site stage intends to assist expatriates enhance their knowledge and skills which in turn would help the expatriate practice in the unfamiliar host country and to be happier and more productive in their work. The case studies in this research indicated that on-site training was desirable. However, as the six case studies revealed on-site cross-cultural training is almost non-existent for most expatriates.

It is proposed that in the on-site stage expatriates should be given induction workshops. The induction workshops are similar to a refresher course for what was done in the pre-departure training workshops. The exception is that the induction should be spread over two half-days. The reason for spreading the induction workshop over two half-days is that a whole day is considered too long and people cannot concentrate and absorb everything if they have to spend a whole day listening to it. Therefore, having the induction for only half a day over two days would be much more effective. The program will be a specific culture preparation program, which would include a review of the construction industry in the UAE and how and if the technical side of work is any different in the UAE compared to Australia. Additionally, expatriates need to think about how to keep out of trouble when they get to the UAE and some of the specific technical skills required. Once they have been in the UAE for a while, they need a refresher course. The first course should be offered about 3 months after arrival, then 6 months and then once a year.

After the new expatriates complete their induction every new expatriate would get a mentor trough the mentoring, coaching and development system (MCDS). A mentoring, coaching and development system was recommended by the six case studies. It is believed that the MCDS would work in the company as a policy where before one can get promoted to the next job, the expatriate need to have completed fifty hours of coaching or mentoring. They would need to have successfully coached or mentored somewhere between seven to ten new expatriates before they can get promoted. This way expatriates will more likely do it willingly, and they may even volunteer.

Essentially the mentoring, coaching and development system is an advanced version of the buddy system. However, for branding and selling proposes it should be called the mentoring, coaching and development system (MSDS).
The MCDS has a number of very useful advantages.
Firstly, it will make sure that there is someone the new expatriate can approach and talk to, or if he/she has a problem or does not understand something there would be someone who can help. Secondly, this type of training acts as a repatriation phase for the mentor(s); this is why a mentoring program would be of utmost importance.
Additionally, having this type of support base and network is very important because the expatriate knows that he/she is not alone and there is someone who can help.

The Repetition Stage
At the repetition stage expatriates will be taking part in refresher workshops. After completing the refresher workshop (three months after arriving) this is followed by a workshop six months after that, and then another refresher course after one year. It is strongly advisable to take into consideration feedback from the nationals on what can be improved in the workshops and to try and implement it; this will help improve the training workshops.
According to research such as (Luthans and Doh 2009) many host country nationals would like to see changes and improvements in some styles of western expatriate managers. Those changes include the expatriate manager's leadership, decision making, communication and group work. In terms of leadership, the following changes would be desirable; expatriate managers need to be friendlier, available and respect subordinates and their suggestions. In terms of decision making, the host

county nations would like to be involved in the decision making process, especially those who will be affected by the decisions made. In terms of communication; the expatriate managers should be doing more group problem solving, with more teamwork as well as encouraging the exchange of opinions and ideas between managers and subordinates. This indicates that the training approaches used need to reflect both the industrial, professional, personal and the cultural environments.

CONCLUSION

There are a vast number of reasons why cross-cultural training is important. From a company perspective, if their expatriates are adequately trained for the overseas assignment they will be more successful by increasing the overall efficiency and profitability and the company will avoid losing hundreds of thousands of dollars. Cross cultural training helps expatriates to improve and be able to interact effectively with local people and co-workers and it helps expatriates to adjust to an unfamiliar environment faster than if they had no training at all. For developmental and functional reasons successful expatriate assignments are invaluable to companies. However, to this day most international Australian companies do not provide their expatriates with adequate, appropriate or up-to date cross-cultural training.

The lack of cross-cultural training or no training at all, is associated with higher expatriate failure rates.

This research has uncovered that the most effective cross-cultural training is training that is delivered in three different stages at different times of the overseas assignment. The reason being that at different stages of the overseas assignment expatriates encounter different experiences and require diverse types of training.

If cross-cultural training is to be offered, it needs to be offered at the pre-departure, on-site and repetition stages, for it to be successful. Additionally, the mentoring, coaching and development system is paramount to expatriates success.

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STRATEGIC MANAGEMENT AS A PILLAR OF A MATURE QUANTITY SURVEYING BUSINESS

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ABSTRACT

The purpose of this study was to ascertain the possibility and search for an initiation point for development or growth. Development or growth should be directed at a main goal which could be called maturity. In order for a quantity surveying business to strive for maturity, the composition of a hypothetical mature quantity surveying business should be known. The question of what the pillars of a hypothetical mature quantity surveying business should be could then be pertinent. The research for this study is primarily based on a qualitative literature review which is supported by a quantitative empirical analysis. The qualitative literature research identified strategic management with four proposed main dimensions. The literature research set the foundation for this research. The value of this research is based on the support that it may offer future researchers to create a maturity model which could serve as a benchmark for quantity surveying businesses. Forty eight national and international quantity surveyors participated in the empirical study. Relevant academic books were studied during the literature study and many other sources which include interviews, internet articles, academic journals, etc. were used. The fact that this research mainly focused on South African conditions could be seen as a limitation. The information from this thesis could however be applied to international conditions in further research.

Keywords: Strategic management, Quantity surveying business, Macroeconomics, Maturity

INTRODUCTION

This paper serves to proof that a successful quantity surveying business should identify target markets and consider the threats, challenges and opportunities of those markets. Assessment of strengths and weaknesses and evaluating threats and opportunities in the market, might assist a business in composing a strategy or means to outperform its competitors.

Stewart, Kornberger and Pitsis (2005: 432) make the statement that almost all organisations have some version of excellence as their universal objective. This objective, as a version of excellence, could also be described as an aspiration to reach a mature state.

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According to Stewart, et al. (2005: 432) strategy has to answer the question, "*What value does the business add to its customers? Do the chosen purpose and the differences that enact it really add anything valuable to potential customers?*" In order for the business to answer these questions, self-examination could be prudent. The value of the product or service should reflect (equal or exceed) the price thereof.

Irons (1995: 118) articulates that strategies in their purest form are about clarifying what needs to be achieved and how to achieve it, all against the background of an understanding of the pattern of external events, and the threats and opportunities they present. The business should understand the markets and identify the demand for the product or service in order to gain an advantage over its competitors.

DEVELOPING AND IMPLEMENTING A STRATEGY

Summarising various definitions from various sources, it seems that strategic management is usually concerned with informed decisions regarding calculated arrangements of business structures, practices and procedures within a business, after all environmental variables have been valued and taken into consideration, with the incentive to reach a certain goal.

Hill and Jones (1998: 10) as well as Pearce and Robinson (2000: 4) state that strategic development should be initiated by top-management, since strategic decisions are integrated into several areas of a business's operations. These statements could be motivated by the fact that it is usually only the top-management that has the perspective needed to understand the broad implications of such decisions and the power to authorize the necessary resource allocations.

Stewart, et al. (2005: 432) support other research which suggests that there are three requirements needed to develop an effective strategy, namely

- A well articulated, stable purpose (mission and or vision);
- Establishing a difference with regard to one's competitors (goals); and
- Developing insights about how to create more value than other businesses (innovation and creativity).

The first step, of the strategic management process, according to Hill and Jones (1998: 6), is defining the mission and major goals of the business. The reason why the mission and major goals of a business could be important might be to provide the context within which strategies could be formulated.

Vision and Mission

Hill and Jones (1998: 6) define the mission as a statement which explains why the business exists and what it should be doing. The mission could also be described as "a plan of action". Katsioloudes (2006: 8) adds the word "purpose" to the definition and refer to different well known businesses where the purpose of the business could be derived from the mission statement.

The purpose of existence could be identified in many mission statements of the larger quantity surveying businesses in South Africa, like the following mission statement

from Davis Langdon: "The core purpose is to make a measurable difference to the value, cost and time of our clients' projects" (Davis Langdon, 2010: 4).

Pearce and Robinson (2000: 27) state that a business must first determine the basic goals and philosophies to shape its strategic stature, whether the business is developing a new business or reformulating a direction for ongoing business.

Pearce and Robinson (2000: 27) go further, articulating that the fundamental purpose that sets a business apart from other similar businesses, is its defined mission statement, because it embodies that business's business philosophy, with regard to its:

- Strategic decision makers;
- The image the business would like to display;
- A reflection of the business's self-concept;
- Indication of the business's main products and services; and
- Exhibiting the business's primary customer need satisfaction.

The mission statement could therefore be an important window to business processes for the business's stakeholders. As Hill and Jones (1998: 39) convey it, "the mission statement is a key indicator of how an organisation views the claims of its stakeholders". Hill and Jones (1998: 39) mention that the mission statement describes how a business intends to incorporate the claims of stakeholders into its strategic decision making and thereby reduce the risk of losing the stakeholder's support.

It could be argued that any mission statement could be better than no mission statement. It could also be argued that a good mission statement could retain existing and attract new stakeholders.

Hill and Jones (1998: 43) state that the mission statement should essentially cover the reason for the business's existence and what it will or should be in the future. It is important to note that Hill and Jones refer to the future. This could mean that the business should anticipate the possible shift in demand for products and services in the future.

For a business to make predictions, it might be necessary to do extensive research and set short-, medium- and long term targets for the business to meet. Hill and Jones (1998: 49) view the establishment of major goals as the next step in the formulation of a mission statement.

Goals

The definition of a goal, according to Hill and Jones (1998: 49), is a desired future state that a business attempts to realise. In this context, the purpose of goals might be to specify with precision what should be done if the business would like to attain its mission.

Goals could be described as "stepping stones" for the business to fulfil its mission. The goals could only serve as "stepping stones" if the goals are well-constructed and consequential to the mission of the business.

For goals to be meaningful it should have four main characteristics (Hill and Jones, 1998: 49):

- First, well-constructed goals should be precise and measurable. Measurable goals could give managers a measure to assess their progress toward attaining their goals.
- A second characteristic of well-constructed goals is that it addresses important issues. To maintain focus a business should operate with a limited number of major goals.
- A third characteristic of well-constructed goals is that they should be challenging but realistic.
- A fourth characteristic of well-constructed goals is that, when appropriate, they should specify a time period in which they should be achieved.

It is only logical that, once meaningful and well-constructed goals have been formulated and communicated to the stakeholders, a "road map" or strategy should be formulated to guide the business in the right direction in order for it to achieve its goals.

Taking into consideration that the business operates in an ever-changing environment, it would not make sense for the business to have rigid and stern goals. Should the environmental changes influence the business in such a way that the goals become unrelated to the mission, it should be possible for the business to correlate the goals accordingly to comply with the mission again. The third part of the strategy identified by Irons above motivates this argument.

Developing adaptable goals could be challenging and calls for creative and innovative strategic management.

Innovation and creativity

"The path to value innovation requires a different competitive mind-set and systematic way of looking for opportunities" (Harvard Business School Publishing Corporation, 2001: 1).

According to an article published in the Harvard Business Review, the authors assert that it could be detrimental to compete head to head with competitors during times when markets are flat or growing slowly (Kim & Mauborgne, 1999: 83). Kim and Mauborgne (1999: 83) are of the opinion that managers know instinctively during flat periods that the only way they can break free from the competition is to be innovative. The problem, according to Kim and Mauborgne (1999: 83), is that managers often do not know how to implement innovation, or where to start.

Incremental improvements in cost or quality or both are often the sole basis for rivals who try to outdo one another when they end up competing (Kim & Mauborgne, 1999: 83).

Strategic decisions and implementation

Hill and Jones (1998: 347) remark that strategic implementation refers to arranging the business structure in a way which will allow the business to pursue its strategy most effectively. This means that strategy should be implemented through organisational design.

Stewart, et al. (2005: 412) concur with Hill and Jones (1998: 347) and mention that the structure of the business should be adapted to the strategic plan, assuming a certain environment. Should the environment change, so should the strategic plan and the business structure. The strategy thus drives the structure.

Pearce and Robinson (2000: 357), state that managers should carefully translate the strategy into implemented actions. Pearce and Robinson (2000: 357) are in agreement with Hill and Jones (1998: 347) maintaining that the strategic actions should be coordinated and motivated by means of initiating four interrelated steps.

Once a business has its vision, mission and goals in place and has altered the structure of the business for strategic implementation, the business has to manage its strategy

STRATEGIC LEADERSHIP

Pearce and Robinson (2000:416) are unambiguous that management and leadership are two separate elements. Management is accordingly identified with skills and leadership with style.

Organisational leadership, according to the abovementioned, involves two considerations; the first, strategic leadership and the other, management skill. An enormous amount has been written about leadership and it is beyond the scope of this study to review this complex topic in detail. It could however be important to note that leadership should be seen as an important element of strategic management.

ENVIRONMENTAL ENVIRONMENT

Possibly the two most important dimensions in any business are external and internal analysis. Any business should be in control of its internal environment (resources and capabilities) but it is understandable that it is very difficult for any business to be in control of its external environment.

External environmental analysis

Grant (2010: 12) views strategy as the link between any business and the business environment. Strategy management, then, is to determine how the business deploys its resources within its environment to satisfy its long-term goals and furthermore, how to organise itself to implement that strategy.

Quantity surveying practices could apply strategy management principles to position themselves favourably towards their target market and could, by doing that, outsmart competitors.

Grant (2010: 122) mentions that strategy is concerned with matching a business's resources and capabilities to the opportunities that arise in the external environment.

Considering the risks and opportunities in the external environment, management must be informed of current and possible future circumstances. Once management is

confident of their comprehension of the external environment they might reflect on the internal business environment to adapt to the external environment for optimum profit.

Internal environmental analysis

Key internal factors could be a business's basic capabilities, limitations, and characteristics. Most businesses organise their operations at some level along functional lines to get their products and services produced, delivered, financed, and accounted. It stands to reason that close scrutiny of each of these functions serves as a compelling, strategically relevant focus for internal analysis. Analysis of past trends in a business's sales, costs, and profitability could be of major importance in identifying its strategic internal factors. This identification should be based on a clear picture of the nature of the business/practices' performance (Pearce & Robinson, 2000: 205).

ETHICS

The definition of "ethics" has come a long way from Aristotle's book "Ethics", which describes the goodness and virtue of mankind. Essentially, ethics could be described as "doing the right things". But why should businesses and strategic managers concern themselves with doing the right things?

Hill and Jones (1998: 59) maintain that any strategic action taken by a business inevitably affects the welfare of its stakeholders, namely employees, clients, stockholders, local communities and the general public. Pettinger (2004: 314) supports the view that ethics is the result of a fully considered view of the relationship between the business and its environment and all points of contact and interaction between them.

Immanuel Kant (1724 – 1804) the philosopher, argued however that the intention with which an action is performed is more important than the action itself (Law, 2007: 103).

EMPIRICAL STUDY

A pre-empted quantity of 70 questionnaires was distributed of which 48 respondents successfully replied within the allowed window period of 30 days. A success response rate of 68.5% was achieved.

The questionnaire first defined the term "strategic management" for unambiguousness and then challenged the respondent to value his/her opinion with regard to the different dimensions as identified above.

Table 1 lists the different dimensions with the average of each dimension divided by 5. The percentages in the last column indicate the respondents' approval with the dimensions. Higher percentages indicate a stronger feeling towards the importance of the dimension and visa versa.

Table 1: Strategic management: Averages

[D]	STRATEGIC MANAGEMENT	AVERAGE FROM 48 RESPONDENTS	
i.	Developing a Strategy	4.10 / 5	82%
ii.	Environmental Analysis	3.70 / 5	74%
iii.	Leadership	4.50 / 5	90%
iv.	Ethics	4.60 / 5	92%
AVERAGE		**4.23 / 5**	**85%**

Source: Own table compiled from returned questionnaires.

From the table it is clear that the majority of the respondents felt that the last dimension "iv. Ethics" is very important with a high favourable percentage of 92%. The dimension with the lowest percentage is "ii. Environmental Analysis" with a favourable percentage of 74%.

Question d4 in the questionnaire is a "balancing" question. The main purpose of the question was to test the respondents' understanding of the preceding questions as well as to finally weight the validity of the proposed pillar. The respondents were of the opinion that "Strategic Management" should be one of the maturity pillars of a quantity surveying business with an average response of 3.60 out of 5. That is a favourable average percentage of 72%. The following graph shows the difference between the averages of questions d1 and d4. The averages of question d1 were calculated in table 9.7 with an overall favourable average percentage of 85%.

CONCLUSION

Through environmental analysis, opportunities and threats could be identified. When opportunities arise a business could take advantage of those conditions to formulate and implement strategies that enable it to earn higher profits. Threats arise when conditions in the external environment endanger the integrity and profitability of the business's business. Adequate strategic management could increase the maturity of a quantity surveying business. Without any strategic management a quantity surveying business could face the danger of cessation. Strategic management is therefore regarded as one of the pillars of a mature quantity surveying business in South Africa.

Figure 1 illustrates the different dimensions of the strategic management pillar as identified in this paper.

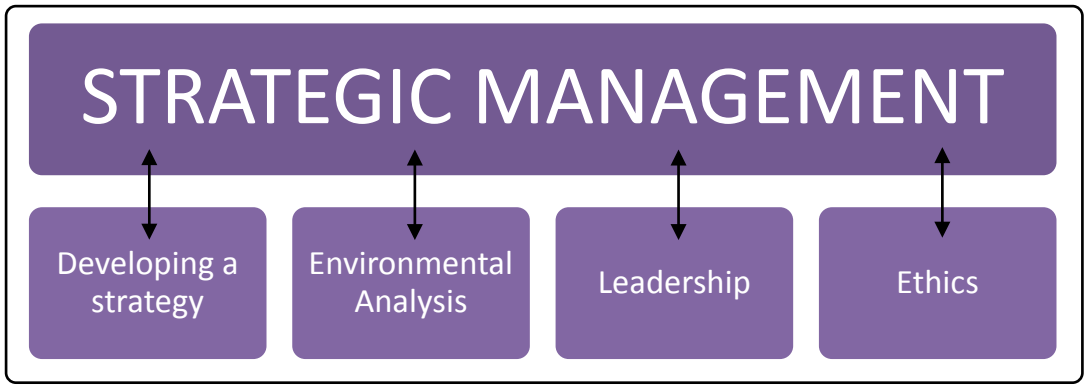

Figure 1: Dimensions of strategic management.
Source: Own table compiled from literature research.

The empirical study supports the literature research which indicates that most quantity surveyors agree that the proposed pillar "Strategic Management" should be regarded as one of the pillars for a hypothetical mature quantity surveying business.

The results from the maturity model could be valuable for the business which is benchmarking itself against the model for the following reasons:

- Areas of strengths and weakness could be highlighted;
- Growth could be scientifically measured;
- Growth could be measured against previous results; and
- Business values (share prices) could be compared to their maturity.

The results could also be valuable for:

- Academic institutions;
- Stocks exchange;
- Government; and
- The Public.

The quantity surveying business maturity profile could be a visual reflection of strengths and weaknesses and could guide businesses towards maturity.
"It is not the strongest- or the most intelligent ones' that survives but the ones' most adaptable to change." Charls Darwin (www.brainyquotes.com; online)

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A REVIEW AND CASE STUDY OF INTEROPERABILITY WITH BUILDING INFORMATION MODELING AND FACILITY MANAGEMENT PROCESSES

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ABSTRACT

The average lifecycle of a building is seventy years, during this time the majority of investment is dedicated to operating and maintaining the building. The information that is developed and collected in the design and the construction of a building is uniquely important to the team that maintains and operates the facility. The information used for operation and maintenance is often times inadequately stored which creates an ineffective, costly, and unorganized information system. Every year in the U.S. an estimated 15.8 billion dollars is lost from the inadequate interoperability of systems within the building lifecycle. With the developments in technology, building information modeling produces greater interoperability of information from the designer and the constructor but continues to be ineffective to the facility management team. The lack of cost effective systems that connect the building information models to the facility management software continue to deny building operators access to the information contained in the building models. This paper includes a review of the industries inefficiency to maximize interoperability throughout the building life cycle, also included is a case study of an owners method to access the information within the building models developed during the design and construction of the building.

Keywords: Building Information Modeling, Facility Management, Interoperability, Operation and Maintenance.

INTRODUCTION

An effective supply chain includes proficient exchange of information, materials, money, manpower, and capital equipment between all parties (Mentzer et al., 2001). A building life cycle includes many disjointed groups within its supply chain; information must transfer between these groups. Designers must transfer countless specifications of the design to the contractors, which then must pass this information on to the operators who maintain the facility. This supply chain is stretched over a seventy year time period (Gallaher et al., 2004; Kelso, 2011), which is why the procedures to manage building information is so unique. With every transition between building controllers, information is diluted and the ability to manage the building effectively decreases. Every year billions

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of dollars are lost in the United States from inefficient procedures managing building information (Gallaher et al., 2004).

Owners and operators can establish the procedures to manage information more efficiently. A productive information management process should be capable of sharing building information with all building operators involved in the life cycle. It should also allow users to create, exchange, analyze, and update information (Smith & Tardif, 2009). The goal of every building owner and operator should be to improve the supply chain and implement the most efficient information technologies to reduce wasted time and resources (Dennis, 2003). Building Information Modeling (BIM) technology has recently increased efficiency of the design and construction of buildings. However, financial benefits with BIM are still unclear with owners and building managers with regards to operations and maintenances (O&M). This paper will review the need for better information exchange throughout the building life cycle focusing on the O&M phase and present a case study on one of the ten largest children's hospital in the United States attempts to improve the process of managing their building information.

Building Life Cycle

A thirty-year life-cycle cost assessment sponsored by the U.S. Department of Energy (see figure 1) states that 2% of the life-cycle cost for a building is due to design and construction, 6% is from operations and maintenance, and the majority 92% is due from the salaries of the personnel that work within the building (Kelso, 2011). With a majority of the cost going to those that are employed within the building, organization leaders will be more focused on employees and less focused on the building itself. The smallest portion of designing and constructing the building greatly impacts the costs related to operating and maintaining the building.

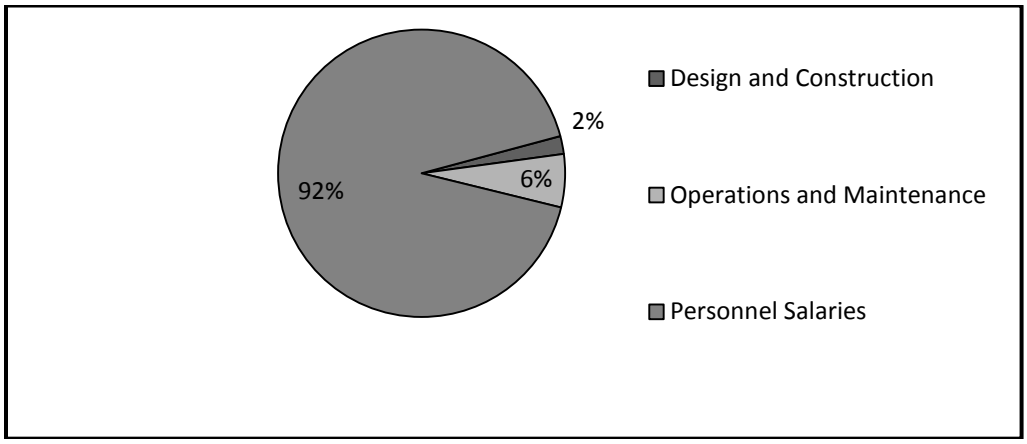

Figure 1: Building Life Cycle Cost Assessment over a 30 year period

Cost savings planned and implemented during the design phase focuses on improving the building efficiency, by lowering maintenance and operation costs in the initial phases owners will have a greater return on investment (Rondeau et al., 1995; Jensen et al., 2009; Thomas, 2010). Unfortunately, building design is mainly focused on the initial capital

investment of the property as many designers hold little responsibility for the financial impact that is included with operating and maintaining the building (Smith, & Tardif, 2009). A mistake found in many construction projects is miscommunication between the design and facility management team while designing a more efficient building to operate. It is the responsibility of the facility manager to be included in the design phases of the building to ensure that owner's best interests are included to maintain their future building (Jensen et al., 2009). The breakdown of communication between the design, construction, and operators is a large area that has resulted in wasted time and money for the owner (Snitkin, 2009).

Inadequate Interoperability

The lost cost due to the inability to exchange information to building managers throughout the building life was captured in a study done by the National Institute of Standards and Technology (NIST) in 2004. The report explored the information interoperability with the facility supply chain. Interoperability can be defined as the ability to transfer, comprehend and utilize information from one system to another. The report estimated 15.8 billion dollars is lost annually in the U.S. through inadequate interoperability. The research focused only on documented loss, which is why the 15.8 billion is considered to be an underestimate of the actual lost capital (Gallaher et al., 2004). The largest area of lost cost is found within operating and maintaining the building, nine billion dollars annually or 57 percent. Table 1 breaks down the O&M lost costs from the NIST report.

Cost Component	**Inadequate Interoperability cost estimate**
Inefficient business process management costs	$1,638,915,000
Redundant facilities management system costs	$456,064,000
Productivity loss and training costs on redundant facility systems	$12,615,000
Redundant facilities management system IT support staffing costs	$10,701,000
Interoperability research and development expenditures	$1,659,000
O&M staff productivity loss	$613,310,000
O&M staff rework loss	$3,952,000
O&M information verification costs	$4,790,159,000
Idled employee costs	$1,499,839,000
TOTAL	$9,027,214,000

Table 1 Lost Cost due to Interoperability found with Operation and Maintenance

The largest four contributions to inadequate interoperability seen from the information passed to the building operators:

1. *O&M information verification cost*

   The majority of organizations do not have a structured handover practice which leads to facility managers verifying that the information handed over is correct and represents the current state of the building. Experienced facility managers have empirical knowledge of the building, but when staff is replaced through retirement

or replacement the information is lost with the knowledge of the departing employee (Smith, & Tardif, 2009).

2. *Inefficient business management cost*

   A study on the efficiency of exchange through different means of communication found paper to lead to the greatest waste in time of information exchange. The study also found that electronic formats can reduce the time necessary to exchange information by 28 to 59 percent (East & Love, 2011). Seventy to ninety percent of the information exchanged in the life-cycle of the building is in a paper format (Gallaher et al., 2004).

   Inadequate information is often the root cause of environmental and safety cost impacts; poor information can lead to incorrect maintenance, overused equipment, unsafe maintenance procedures, or premature replacement (Snitkin, & Mick, 2010).

3. *Idled employee costs*

   Studies have shown that O&M staff will waste up to 40 percent of their time by searching unorganized and inaccurate information (Snitkin, & Mick, 2010).

4. *O&M staff productivity loss*

   If the information lacks validity or is missing O&M staff will lose confidence in the business structure, and the information that it contains. As-built documents in particular, should represent the current state of the facility that can be analyzed by the staff and allow edits and updatse to assist future renovations. Surveys of facility managers within the U.S. Army and in the private sector have shown that most as-built documents are not accurate and difficult to find (Clayton et al., 1999).

The NIST report concluded that owners can minimize the lost cost with improved technologies that link information developed during design, construction, and O&M into one information management system. The current build industries continue to promote Building Information Modeling (BIM) as the technology that will minimize the lost cost of inadequate interoperability. By improving the way in which information is passed from designer and constructors to the owners, it eliminates the need for boxes of construction documents, warranty's, and invoice documents to be passed to owners after the completion of the building. It will also eliminate the necessity of facility management departments to reassess the completed building to update as-builts from the construction period (East, 2007).

Facility Management Struggles with BIM

Relevantly new to the facility management industry, BIM records valuable information on the building systems and materials collected during design and construction of the

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building. BIM provides great potential to improve interoperability to FM information management processes and is promoted continuously to the facility management industry.

The reason that BIM has not developed largely in the facility management industry is due to the reasonableness and return on investment of the product. In a 2008 survey, facility managers found the top five reasons operators will not invest in BIM (Forns-Samso, 2008):

1. Unwilling to change process – the majority of existing buildings are going to have a method of maintenance, data storage, and building drawings. A large ROI would be required for a facility to change their traditional way of operating;
2. Funding/cost - the cost of creating a BIM model on an existing building greatly outweighs the current abilities that 3D models assist facility managers. An estimated cost of creating a BIM department within an organization is $100,000 to $120,000 (Hardin, 2009). Often time's facility budgets are too limited to maintain the building properly, the percentage of facilities that have the extra capital to invest in digital models is very small;
3. Lack of understanding – understanding the benefits of BIM in facility management is still being researched. Facility managers that have not been introduced to 3D modeling do not understand why 3D would benefit their operations;
4. Lack of personnel and resources - most software's that are available to facility managers are not compatible with puling data from the 3D models that are produced in design and construction. The very small exceptions of software that have begun to include 3D models are still primitive in their development;
5. Data updating/ maintenance – once a model is handed over to the facility managers; various products are required to maintain the model. The numerous building systems in a structure require different software for updating. Software that can edit and navigate the entire model still does not exist. If the owner invests in the cost of the technology required they will also need to pay for an in-house BIM manager to maintain their software consistently.

Although the issues related with BIM and facility management are prevalent the pace of technology and education continue to work to link the two. Many government agencies and private business have begun to require 3D models with the handover of their buildings (BIM Initiatives, 2010). Government agencies, research developers, software designers, and facility managers are investigating how they will propel the facility industry into the benefits of BIM.

CASE STUDY

Background

In an attempt to minimize the lost information during the building life cycle and to incorporate BIM into facility management a team of designers, contractors, and operators of a hospital facility developed an electronic information exchange for the new addition of their existing facility. The Phoenix Children's Hospital (PCH) in Arizona is one of the largest children's hospitals in the United States. To manage the growing population in the

Phoenix area the hospital expanded its facilities by 770,000 square feet in 2008. The project included additions to existing hospital facilities that would continue to operate, which required preplanning to ensure that the construction would not disturb the hospital operations. With the safety hazards and the complex building systems, the designers and contractors recommended that BIM model should be used to minimize risk with the project. PCH recognized the benefits of the BIM model and required that it would be handed over to their facility management organization so that they would be able to incorporate the models into maintaining the facility. Their experience with incorporating information from BIM models is a recent case study for the construction industry's ability to exchange information electronically to the operators.

Development

Although existing procedures were established to maintain their building information, the operators were willing to change their processes to fit the outcomes with the 3D models. Laser scanning was performed on the existing facilities so the new 3D models would align to the buildings. The construction company contracted was very proactive with the facility management team on getting them involved with the construction of the facility and persisted to ensure that FM team would have the information needed to operate the building. The design, construction, and FM teams would have weekly meetings in which they could collaborate on the construction of the building and determine what information would be needed for maintenance after completion of construction. The information that the FM team would need was recorded and was linked to an asset-management tool that would be handed over to the O&M team. As the project progressed, as-builts of the construction were updated in the model to ensure that the model was completely accurate to what was constructed. Looking back at the collaboration that was managed during the construction the facility director would have liked to start this same level of collaboration earlier in the design phases of the building (Laster, 2011).

Handover

As the project neared completion, the information that was developed in the model was linked to an asset-management tool that was an online interactive tool developed by the contractor. The handover of information occurred over many months and multiple versions to ensure that all building information was included. The final proprietary tool provided by the contractor is a web-based instrument panel that allows facility management to locate information quickly on the building. The facility team can locate building information with a few clicks of the mouse to access information that previously was stored in poorly organized boxes. The asset-management tool links to equipment data, service manuals, equipment performance, warranty, manufacturer contacts, and video. The video contained the installation and maintenance procedures and are available for technicians to review before maintenance.

The asset-management tool is also linked to the BIM models in which operators can quickly pull up 3D models of the building, complicated systems within the building, and 2D layouts of areas in the building. The 3D models are linked to Autodesk Naviswork, which allows viewing of the 3D models and is linked to the stored information on the different systems within the building. The cost of the software was included in the contract

and allowed the facility team to view the 3D models on select stations (Laster, 2011). Although no extensive training is needed for Naviswork, it does not allow the operators to update the model when reconstruction of the building occurs. This is one of the limitations of the system it is also unable to link directly to the operator's computerized maintenance management systems, which manage the maintenance work of the facility.

CONCLUSION

In conclusion, billions of dollars are lost yearly from the inability to pass building information effectively from design and construction to the owners and operators. Future technology should continue to develop the ability for information to be passed down throughout the building life cycle. Even with the many benefits of BIM in the construction of buildings, facility managers still have many reasons not to invest in BIM models. The presented case study demonstrates one method that is currently available to facility managers to receive an electronic information exchange through a web based interactive tool. Many limitations still exist with this method of utilizing the information in the BIM models, but the industry is showing progress towards incorporating the information rich 3D models into facility management.

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ICT IN SITE MANAGEMENT PROCESS IN SOUTH AFRICA

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ABSTRACT

Integration of Information and Communication Technology in the Site Management Process; is the topic of interest in the paper. With focus on the South African construction industry, results of a pilot study investigating integration of ICT in the Site Management Process are presented. Review of purposively sampled literature, complimented by survey on a limited sample; is used to generate contextual deductions. The paper is part of a wider research agenda in Construction ICT. However findings from the pilot study suggest considerable lack of awareness, familiarity, and utilization of available ICT-based products (software, hardware and technologies) by practitioners. In addition there seems to be a negative correlation between familiarity with technologies, their usage and depth of utilisation at work.

Keywords: adoption, ICT, innovation diffusion, SMP, technology transfer.

INTRODUCTION

The construction industry is an influential economic sector, which utilises human, material and financial resources. Construction activities are labour and capital intensive, providing favourable ground for economic empowerment (Thwala, 2005). Presently the construction industry has become a global arena. Complexity and competitiveness have increased with influx of global participants in projects (Liu & Erickson, 2002; Sarshar & Isikdag, 2004). Fundamental changes across old professional categories, and project teams were noted by the 1990s (Howard, 1998). The worldwide growth of construction industry is evident in the adoption of technological and scientific innovations (Haas & Saidi, 2005; Shakantu & Kajimo-Shakantu, 2006). Despite dividends from various adopted innovations, the need for more technology integration remains a challenge to construction (Flanagan et al., 2001). Modern construction is complex and has physical realities, which point to a need for more technology such as Information and Communication Technology (ICT). Such needs of the contemporary construction site are evident in the Site Management Process (SMP) (Fuller & Sattineni, 2002; Cabarello, 2002). Growth of

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ICT presents more opportunities for ICT integration in construction. However the construction industry is regarded as lagging behind in the adoption of ICT despite perceived advantages (Shakantu & Kajimo-Shakantu, 2006). Utilisation of ICT in construction does not take full advantage of potential uses (Haas & Saidi, 2005). Barriers to success in this regard especially for the SMP point towards the need for a different approach to ICT implementation. There have been calls for more innovation in the adoption of ICT in construction. It has also been emphasised that such approaches should work from a sound knowledge of the construction environment, its participants, and developments in ICT (Ugwu & Kumaraswamy, 2007).

The background and needs highlighted above informed the design of a postgraduate research project. The main aim was to investigate integration of information and communication technology, in the South African construction industry; using the SMP as context. Work presented in the paper is an excerpt from preliminary studies carried out during the degree project; under the banner of Construction Information and Communication Technology (CICT).

CONCEPTUAL AND THEORETICAL BASIS FOR THE STUDY

ICT utilisation in the SMP as presented here concerns the following main concepts: Technology transfer, innovation, adoption and diffusion. The study investigates the intersection of these concepts in the context of ICT, the SMP and the South African construction industry.

Innovation

Innovation has been defined as the successful exploitation of an idea in a new unit of adoption (Egbu, 2001 in Fryer, Egbu, Ellis and Gorse, 2004). From a management point of view, innovation is described as the heart of entrepreneurship or entrepreneurial activity which inspires enterprise wide, economic and social change (Drucker, 1998). From a construction perspective innovation can also be described as a new concept which is adopted by a client in a construction project. The aim would be to derive increased benefits through returns on investment (Ling, Hartman, Kumaraswamy and Dulaimi, 2007). Innovations, especially the technological kind, go through creation and diffusion stages in their life cycle (McGinn, 1991: 80-81).

Diffusion

Diffusion involves dispersion or physical movement of substance. ‘Substance’ here could be anyone of a broad range of things, subjects, objects, and information among others (Morales and Gilner, 2010). Rogers and Shoemaker (1971) identified eight scholarly traditions of diffusion. The relevant tradition here is diffusion of innovations. It is defined as a communication process through channels, by which an innovation is communicated to the units / members of a social system (Rogers and Shoemaker, 1971). Diffusion of innovations rests on adoption and time frame of adoption of each innovation within a particular setting. Adoption occurs when a party decides and acts upon the decision to employ or utilise an innovation. The time lapse between the first cognitive interaction of the innovation and the final adoption becomes the time frame of innovation diffusion (Rogers, 2003).

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Technology transfer
Similarly, Technology transfer could be described as movement of technology to various other contexts; by communicating and adapting the innovation to each context (International Council of Scientific Unions (ICSU) and Committee on Science and Technology in Developing Countries (COSTED), 1980: 159). Technology Transfer is also described as the spread and adoption of inventions and techniques from one discipline to another, and from one sector to another (Parker, 2010). Thus technology transfer embodies the essence of innovation, diffusion and adoption.

The Site Management Process (SMP) and need for ICT
Within the focus of study, relevant concepts relate to the diffusion and adoption of technological innovations of ICT in the SMP, as a consequence of technology transfer. The SMP is a complex field, involving planning and continuous application of various management functions, on site throughout the construction phase (Forster, 1995). The ad hoc nature of construction projects encourages the use of matrix organisational structure in site management (Kuprenas, 2002; Hendrickson, 2003). However the site remains a highly volatile environment which could erupt in many issues that affect its management in various ways (Forster, 1995). Increases in project complexity and volume of stakeholders, expectedly stretches site management capacity. Increased strain on process management would translate to project delivery problems, which influence client satisfaction (Ozumba & Shakantu, 2008a). The consequence would be sub-optimal levels of performance. In addition, human limitations create practical management capacity issues such as ubiquity, which plagues management of construction site processes (Ozumba & Shakantu, 2008b).

The scenario above is more evident with current global developments which have made the industry more accessible, especially in developing countries (Ozumba and Shakantu, 2008a). The above mentioned situations are particularly true in emerging economies such as South Africa. Causative factors include the multiplying effects of socio-economic and political realities in so called ‘developing countries’. As shown in (Ofori, 2000), the construction industry in developing countries faces the double impacts of globalisation and culture, and the desperate need for physical development. Management of projects is bound to become even more critical under such circumstances. Thus there is appreciable need for efficient site management in the setting described. The stated need for process enhancement could be achieved through employment of technology such as ICT and related types (Ozumba & Shakantu, 2008a). On the strength of concepts reviewed, the study concentrates on transfer of ICT in the South African construction industry. The SMP is used as context. Therefore investigations are focused on management level practitioners within the SMP.

METHODOLOGY

The study presented here is part of a postgraduate degree project; performed as part of initial studies in the data collection stage. The overall methodology utilised a combined approach which included survey by questionnaire. Data analysed for the paper was collected using survey method (Creswell, 2003).

The pilot survey was limited to practitioners within the Gauteng region of South Africa which is the business centre of the country. Essentially, the Greater Johannesburg area was used. Participants included construction managers and project managers and all who are involved in the construction site processes, at management level. They were essentially people in middle and first line management, and supervisory levels on construction projects. Data for the study was collected in 2011. The time frame covered in the questionnaire was (2008 – 2011). Participants responded to questions fielded for a range of ICT products, technologies and services; numbering 27 in all. Items of ICT studied were grouped into 5 categories namely: Mobile / handheld devices, Geographic and surveillance systems; Sensors and scanners, Hybrid technologies (BIM, Telepresence etc.), and wireless applications and services.

The following constructs were developed for the pilot study: Familiarity with the ICT; ICT usage within time frame of study; ICT utilisation in project stages; physical areas of utilisation; specific site management work of ICT utilisation; and product features utilisation. The pilot study at this stage was basically exploratory. However the questionnaire was largely structured, to reduce ambiguity and misinterpretation. Questionnaires were administered twice in sequence, targeting members of two professional bodies in the built environment. All together 15 practitioners participated in the pilot study. Questionnaires were distributed electronically, in excel and PDF versions. All 15 completed questionnaires were then analysed. Respondents cut across various core disciplines in the construction industry, and have all been involved in the site management process. Such purposive sampling was deemed adequate for the pilot stage of the study. Descriptive analysis was also used at this stage; considering the purpose and sample. Analysis and findings are presented according to the constructs explored. At this stage, the analysis leads to suggestions through which propositions were formed for the main research work.

SUMMARY OF ANALYSIS AND FINDINGS

For the purpose of the paper, analysis and findings are summarised. A binary mode was used for data entry where (yes = 1, and no = 0). For practicality values in each case were added up for all 27 items of ICT. Expected values for each construct were calculated and used to evaluate values derived from responses. Thus a first attempt at painting a picture of the situation on ground was made. Using the sample of 15 respondents, results are presented as approximate proportions of expected values, and also proportions of the sample. For a sample size of 15 and possible observations of "YES" for 27 items of ICT, highest possible value of observations is 405 = (15 x 27). Highest observable sample mean is 15 = (405 / 27). Similarly by proportion, 405 represents 100% (highest possible observation value). Thus any observation falling below 405 is calculated as a percentage of 405.

For familiarity with the product, expected value is 405 while response was scored 251, making it approximately 61%. Under time span of usage (2008 – 2011), respondents scored very low at 23% (375 out of 1620 of expected value). ICT utilisation in project stages concentrated on utilisation during the site or construction phase of projects. For this construct respondents scored low at 31% of expected value

(405). Product features utilisation queried the depth of usage of the features incorporated in each item of ICT, among respondents. The score was similarly low, at 28% of expected value (405).

For site management work of ICT utilisation, the aim was to ascertain the exact function performed with the aid of ICT on site. It is then possible to group various functions indicated, in order to get a picture of major types of usage. Responses were fairly grouped into 6 categories namely: health and safety, access control and security; laser measurements, and identification of hidden objects and lines; site administration, supervision and labour management; logistics and control of materials and equipment; site and project level communication, and information management; and project location verification, setting out and topographic surveys. Of all the above mentioned, general administration of the site was the most indicated. Communication was also equally indicated, but referred mostly to phone calls and the use of emails.

Other highlights include the self-assessment for utilisation of product features. For the purpose of analysing this section, ICT investigated were grouped into 5 categories: Mobile / handheld devices, Geographic and surveillance systems; Sensors and scanners, Hybrid technologies (BIM, Telepresence etc.), and wireless applications and services. Most respondents indicated very high utilisation of mobile/handheld devices. However some of the hybrid technologies and wireless services were not utilised.

DISCUSSION

Generally, usage of the range of ICT in the study was quite low or non-existent in most cases. Response about specific areas of utilisation suggests minimal usage recent ICT in the SMP, during the construction phase, and on site. At best responses suggest very little innovative usage of ICT. They seem to be used for specific purposes though some of the items are versatile in terms of capacity. Furthermore majority of respondents did not indicate familiarity with all items studied, especially some more recent items in the hybrid technologies category. Hence the seeming awareness of ICT among participants, does not translate to commensurate working knowledge and utilisation. The contrast between awareness of ICT and its usage suggests the occurrence of a much larger innovation adoption time frame. The suggestion is further supported by the rate of utilisation observed within the time frame of research.

CONCLUSION

As stated earlier, the study forms part of preliminary work in the course of a post graduate degree. Thus delimitations of time, scope and sampling were placed on it. A larger sample size could be accessed at the time of the pilot study. However it was designed to further clarify directions and adjust the inquiry for the degree project. As such it is possible to draw directions for a more representative research. Therefore only suggestions were made at this juncture. The suggestions have been used to formulate propositions guiding the main research project. They are presented below as possible implications.

Analysis of the survey response suggests that people in the sample population may be poorly exposed to relevant developments in ICT and allied industries. Secondly it seems that utilisation of ICT in the specific context of the study, is limited to pre-set capabilities / features that can be easily grasped. Thirdly, there seems not be much innovation in the usage of items of ICT studied. Fourthly there seems to be very poor awareness of possibilities in ICT such as virtual reality, augmented reality, Telepresence and Building Information Modelling, among others. Such low levels of awareness would negatively affect useful exploitation of recent ICT in the SMP, and other aspects of construction. The last point speaks to management issues surrounding ICT utilisation in construction generally. Much of the awareness indicated does not seem to translate into utilisation. It is possible that management does not provide for such technologies in projects. Another reason could be that respondents were involved in projects which were deemed not to require such technologies. Both of these reasons proffered here would be partly as a result of poor information and probably poor innovativeness.

Generally issues highlighted point towards the need for further investigations. There is also the contextual issue which could be a strong influence on the use of ICT in construction, in this particular case. There could be ICT utilisation specific peculiarities to be found amongst the management class of construction practitioners in South Africa. The representativeness of ICT manufacturers and their products, in South Africa and its construction industry could be a major factor. A key question developing from the findings concerns the mind-set; at industry, corporate, project and individual levels, of interaction with various types of technology. In furthering the study it is necessary to consider diffusion patterns of successfully adopted technologies in construction. It could be insightful also to understand what peculiar factors if any, influence the diffusion process for ICT and related technologies, within the SMP in South Africa.

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QUANTITATIVE ANALYSIS OF ICT UTILIZATION PROBLEMS IN THE IRANIAN CONSTRUCTION INDUSTRY

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ABSTRACT

Fast development of computer, information and communication technology (ICT) has resulted many changes in using of information and knowledge in construction industry. Construction companies have used ICT because they believe that it increases efficiency and safety of their projects and give them the power to compete in the market. In Iran, construction firms have utilized ICT tools in their projects for several years. However they have encountered some problems during adoption of ICT. This research identified some of these problems through a set of interviews with highly experienced construction practitioners and software providers. To determine the severity of each problem, a questionnaire was developed and distributed among senior managers and experts of five civil organizations and construction associations. The returned questionnaires were analyzed quantitatively and the problems were ranked based on their importance. Weak ICT infrastructure, low speed internet and shortage of ICT training to construction practitioners are the three main problems of ICT adoption in the Iranian construction industry.

Keywords: construction projects, ICT, Iran, quantitative analysis.

INTRODUCTION

Information and communication technology include a wide rang of software and hardware and communication tools which can facilitate the heavy calculations, visualization and design process of construction projects. Construction firms have utilized ICT tools to reduce the cost and time of their projects and make much benefit from their works. Effective communication will help managers make on time decision and better manage the project by having updated information and fast communication with other parties. Information are saved and kept in electronic formats so fast and easy access to data is possible by new documentation and archive systems.

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In the recent years, Iranian construction companies have increased using of ICT. However, they have encountered with some problems and barriers to adopt ICT in their projects (Alaghbandrad et al. 2011). To overcome these problems, at the first step, they should be identified and categorized carefully, then, be ranked based on their severity. This research aims to quantitatively analyse the ICT utilization problems in the Iranian construction industry.

PREVIOUS RESEARCH

The great values that ICT can bring for construction industry are emphasized in many researches which were conducted in different countries: peansupap et al. (2006), Williams et al. (2007), Hewage et al. (2008), Kaplinski (2008), Adejimi (2009), Ahuja et al. (2009), Isikdag et al. (2009), Abdul Kareem et al. (2011), Underwood and Khosrowshahi (2012).

Abdul Kareem et al. (2011) found some benefits of implementing Information Technology (IT) in construction projects in Malaysia such as client satisfaction, cost reduction, improving management, competitiveness advantages, improving information quality, increasing work flexibility and reducing working time. They also noted some problems of IT adoption process in Malaysian construction industry such as insufficient bandwidth, lack of training and unavailability of expert users in construction companies.

Through a research in India, Ahuja et al. (2009) understood that for SMEs (Small and Medium Enterprises) initial cost and cost of updating IT infrastructure are important barriers for ICT adoption in building projects. Ahuja et al. (2009) recommended that ICT capabilities of SMEs need to be improved by providing education and training facilities for staff members. SMEs should make strategic plan for future use of ICT in their companies.

In Turkey, Isikdag et al. (2009) conducted a series of semi-structured interview with contractors and consultants to investigate three points, 1- the role of ICT strategy in organizations, 2- reasons of investments in ICT and 3- barriers to successful implementation of ICT in organizations. Ill-defined process is explained as a major barrier.

In Alberta, Canada, Hewage et al. (2008) revealed that the managers are worried about skills of workers in construction sites if IT becomes a part of work place. The managers expressed that they have experienced resistance of older workers whenever a new technology is adopted. Lack of industry-wide standard, lack of manager interest on IT, lack of funding, lack of knowledgeable people for new innovation, unclear needs and human issues are the main issues of technology providers in Alberta.

In his research, Kaplinski (2008) indicated that expenditure and investment in IT tools in construction sector is insufficient in poland.

Based on the findings of Peansupap et al. (2006) study, constraints of ICT implementation in the Australian construction industry at the personal level include limited budget for ICT investment, commitment from other project participants, issues of ICT standardisation, and security problems. At the organisational level, constraints include basic levels computer experience, time available to learn, and the identification of clear benefits of ICT use. Constraints at the group level include time available to share information, quality of personal contact and geographical distance.

Williams et al. (2007) research indicated that reluctance by project participants to share data and information is the most important barrier of using of web-based IT in the U.S. Need for training, high cost of implementation and little return on investment are other important barriers.

Underwood and Khosrowshahi (2012) stated that the majority of organisations in the UK intended to 'flat-line' or reduce ICT operating budgets in 2010 owing to the global economic crisis. They expected that this issue continues up to the point that organisations observe a sign of improvement in the economic condition.

ICT in Iran

Alaghbandrad et al. (2010) found that the Iranian construction firms invest in ICT tools based on their needs and functionality of the facility. Quality in ICT application is a key for construction organizations. However, investing wisely is a priority for the managers. The important parts of a typical automation system in Iranian construction companies are archiving, personnel management and communication.

Alaghbandrad et al. (2011) identified the most important factors which should be considered to transform problems to opportunities as following: infrastructure, cultural matters, training, regulations, user friendliness, financial issues and the lack of a common standard for ICT adoption among firms.

Alaghbandrad et al. (2012) understood that barriers and problems of ICT utilization in construction sites in Iran can be described in seven categories: poor ICT infrastructure, lack of local personnel familiar with ICT systems in remote construction sites, no economic justification for ICT training of personnel in small construction sites, lack of feeling transfer in some electronic communication tools (e.g. video conference), inapplicable software outputs, complicated administrative process for ICT development, and poor back up system in remote construction sites.

RESEARCH METHODOLOGY

Each research can benefit from different ways and tools. The literature review helps researchers to know the previous efforts in the research area. The interview is one of the data collecting methods. It helps the researcher benefit from experience, personal histories and perspectives of experts and experienced people (Bryman and Bell 2003). Selected sampling is the best sampling method for qualitative interviewing (Naoum 2007).

This paper is part of a broader research that benefits from interviews and questionnaire for collecting data. This paper presents results of quantitative analysis carried out on data collected from 55 questionnaires.

At the first phase of this research, twelve semi-structured interviews were conducted with highly experienced construction practitioners and senior managers in construction organizations and software providers. The interviewees were selected carefully from experienced experts and managers who were familiar with construction environment and ICT application in construction in Iran. During the interviews, the respondents were asked about the problems and barriers of ICT adoption in their firms. The interviews were continued up to the point that the responses were repeated and no new information were obtained from interviewees (data saturation). Then the interviews were qualitatively analyzed and the main problems were highlighted.

In the second phase of research, a questionnaire was developed and distributed among senior managers and experts of five civil organizations and associations to determine the severity of each problem. The filled questionnaires were analyzed quantitatively.

In the questionnaire, first, a brief definition and explanation about ICT and its application in construction was written. Then, the respondents were asked to answer some personal questions about their position in company, education and work experience. They were also asked about their knowledge of ICT application in construction, use of personal computer and access to internet in their work places. Then, they give their opinion about the situation of using ICT in their organizations. Finally, 14 main problems of ICT adoption in the Iranian construction industry were presented in a table and the respondents were asked to choose an option based on the severity of each problem and the options were scored based on Likert Scale as following: “very important=5”, ”important=4”, ”somewhat important=3”, “less important=2”, “non important=1”

This is a scale developed by Rensis Likert for measuring the degree to which people agree or disagree with a statement, usually on a 3-, 5-, or 7-point scale(Adejimi 2009).

After collecting the questionnaire, statistical analysis was started. Mean and standard deviation were calculated to better describe the results. The average score of respondents is indicated by “mean” and the “standard deviation” shows the variation from the mean. To facilitate the heavy volume of calculation, Statistical Package for Social Sciences (SPSS) software is employed. To rank the problems, each one was given a score. This score comes from the average (mean) of responses for severity of each problem.

Based on the obtained data, the education level of 55 respondents is: 1 person high school diploma, 24 people bachelor degree, 25 people master degree and 5 people PhD. The field of study of 29 respondents were civil engineering, 9 people architecture, 2 people management and the other 15 respondents miscellaneous. 17 people had work experience of 1-4 years, 3 people 5-9 years, 9 people 10-14 years and 27 respondents had more than 15 years of work experience. Based on the responses, 14.3% respondents stated that they are quite familiar with the ICT application in construction, 53.6% were familiar, 23.2% were somewhat familiar, 5.4% were less familiar and 3.6% were not familiar at all. All respondents had personal computer in their work place and all people except one who did not answer, had access to internet in their work place. 17.9% respondents chose “very much” as answer for appraisal of ICT application in their work place, 32.1% said “much”, 37.5% said “average”, 8.9% said “little”, 1.8% chose “very little” and 1.8% did not respond to this question.

DATA ANALYSIS

Data gathered from the interviews were qualitatively analysed. Based on the information obtained from the interviewees, the ICT utilization problems in the Iranian construction industry are categorized in 14 groups. To clarify the severity and importance of each problem, a questionnaire was developed and distributed to 55 senior managers and experts in Iranian construction industry. The data was quantitatively analysed.

Qualitative data analysis

During the interviews, the respondents were asked about the problems and barriers of ICT adoption in their firms. These problems are expressed in the following:

1-Weak ICT infrastructure: Most of the respondents believe that Iranian ICT infrastructure must be improved. The availability and quality of ICT in far-off lands in the country is very important because most construction and civil projects are located far from cities while the ICT is a vital need for these projects.

2-Shortage of ICT training to construction practitioners: Knowledge and skill in ICT is an important item for construction practitioners. Providing enough training for construction personnel within firms is a significant factor in success of ICT adoption in companies. The training courses must be tailored to real needs of each company.

3-Information security and confidentiality: Some of respondents were worried about security of information in the electronic format. They believed that storing data in electronic files increases the risk of information leakage from data storages. In fact, there is a lack of trust about security of information in electronic format.

4-Possibility of data loss: Information storages are vulnerable against events such as electricity fluctuation, hit damage and water penetration.

5-Lack of interest in using ICT tools among older construction practitioners: Some of construction practitioners avoid using new technologies and ICT tools in their work. They resist against the automation systems because they think that these new tools will do their duties and can make them unemployed. This attitude is much seen in elderly people. They also sometimes think that the ICT tools are not helping them in doing their job.

6-Lack of trust in output of construction softwares: Some of the respondents believed that the output of design and construction software is not as much precise as needed. The results may not be constructible in real world and cannot be trusted particularly when an unskilled designer is using the software.

7-Incompatible rules of construction industry with ICT: Most of the current rules of construction industry are formed in a world without ICT. They are not compatible with the needs of new technologies. For example, one of the respondents said that the electronic signature is not usually acceptable in administrative process of construction projects.

8-Shortage of user-friendly softwares: Making a user friendly graphic environment can encourage users to learn the software and use it more. A graphic environment which is similar to famous softwares (e.g. MS Word) can help the users how to work with the software easier and faster. Shortage of user friendly software can discourage construction practitioners to use them.

9-Poor support of ICT providers in construction industry: The support of ICT developers is an important factor which can encourage users to use their products more. Poor support can result in leaving new technology and returning to traditional methods in information and communication management in construction.

10-Low financial support of construction companies for investment in ICT: Investment in ICT is a critical problem in some of construction companies in Iran. In some cases, the firms are not in a stable financial status. They cannot be sure of their expected profit. As a result, they will not invest in ICT systems adequately.

11-Lack of a national standard for ICT utilization in construction: Assigning a national standard of ICT for construction industry was mentioned as a vital need for this industry. This standard must force the construction companies to use a minimum level of ICT in their projects.

12-Low speed internet: Most of the interviewees were not satisfied with internet speed. The main problems associated to internet were low speed and frequent disconnection. Also no access to internet in undeveloped regions was a serious problem that construction companies have to solve it themselves.

13-Preference of in-person communication on electronic communication in construction projects: ICT provides electronic communication tools for construction projects. These tools reduce costs and time of in-person visits and meetings. However, sometimes construction practitioners, particularly managers, prefer in-person communication. That is due to a belief that better supervision can be done in physical meetings.

14-Complex and time-consuming process of getting permission for using ICT: being equipped with some electronic equipment like wireless communication or installing communication tools in place of projects, sometimes needs permission from government authorities. The process of getting permission from these authorities will be complex and time-consuming in many cases.

Quantitative data analysis

After the qualitative data analysis, the main problems of ICT utilization in the Iranian construction industry were ranked based on the severity. The result is presented in Table 1.

Table 1. Problems ranking of ICT adoption in the Iranian construction industry

Problem	N	Minimum score	Maximum score	Mean	Std. Devition
Weak ICT infrastructure	55	3	5	4.5636	0.56972
Low speed internet	54	3	5	4.4815	0.66562
Shortage of ICT training to construction practitioners	55	2	5	4.2727	0.78066
Possibility of data loss	54	1	5	3.9815	1.07266
Lack of a national standard for ICT utilization in construction	54	2	5	3.9815	0.81242
Poor support of ICT providers	54	2	5	3.9630	0.77613
Preference of in-person communication on electronic communication in construction projects	54	1	5	3.8704	0.91211
Low financial support of construction companies for investment in ICT	55	1	5	3.7455	1.04025
Lack of interest in using ICT tools among older construction practitioners	54	1	5	3.7407	0.91497
Information security and confidentiality	54	1	5	3.6852	1.06087
Complex and time-consuming process of getting permission for	52	1	5	3.5385	0.99925

using ICT					
Shortage of user friendly softwares	54	1	5	3.5	0.92655
Incompatible rules of construction industry with ICT	50	1	5	3.46	1.14660
Lack of trust in output of construction softwares	55	2	5	3.2909	0.95593

(N: number of responses)

CONCLUSIONS

This paper presents result of a quantitative analysis to rank the main problems and barriers of ICT utilization in the Iranian construction industry based on the severity of each problem. To reach this goal, after a set of interviews and identifying the main problems by qualitative analysis, a questionnaire is developed and distributed to highly experienced experts and managers of construction industry. The results of quantitative analysis reveal that the three main problems are weak ICT infrastructure, low speed internet and shortage of ICT training to construction practitioners. The future efforts to solve the major problems must be focused on improving ICT infrastructure. Internet speed and quality must be improved and internet access should be extended across the country. The construction personnel should be trained in companies based on the specific needs of that company. The security of information storages must be increased to avoid data loss and leakage. A national standard must be developed for using ICT in construction. ICT providers should support their products more and provide user-friendly programs with reliable outputs. Construction companies have to invest more in developing ICT in their organizations. The value of electronic communication should be explained to top managers and other personnel of construction firms. Particularly older people should be encouraged to use ICT. Authorities should adapt rules to modern world with new technologies and facilitate the permission of using communication equipment for civil activities.

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THE 5D QS: TODAY'S METHODOLOGY IN COST CERTAINTY

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ABSTRACT

This paper looks critically at where BIM implementation is on the pathway and sets out the opportunities that arise when 5D (the linking of cost information to a 3D model) is considered to be more than just a quantity take-off exercise. It proposes a methodology, from a practitioner's perspective, for applying 5D BIM to the design and construction of projects with the goal of delivering better buildings with cost certainty. A fundamental of the methodology is to use existing, proven technologies to overcome the problems that exist when the onus is on the BIM author to code model objects in a fashion that estimators can understand. The purpose and intention of this paper is simply to provide context and to start the discussion on what 5D BIM is with a view to developing a mainstream methodology that can be included within a BIM execution plan for a project.

Keywords: 5D BIM, Collaboration, Cost Strategy, Living Cost Planning, Transparency.

INTRODUCTION

To date, a lot of the focus on Building Information Modeling (BIM) implementation has simply been about design firms learning how parametric 3D modeling software works.

Design firms have been learning about the capabilities of their chosen BIM authoring tool, gauging the benefits to the firm, achieving a level of confidence in an isolated way and exploring collaborative work flows where information is exchanged in two directions.

Working against an even more collaborative approach is a belief that BIM can only add value to large projects and when Integrated Project Delivery (IPD) is the preferred delivery system. Whilst integration is the long term outcome, industry is currently grappling with the issues surrounding collaboration and is now starting to solve the stumbling blocks of liability, ownership and protection of data and intellectual property. The development of BIM guides and execution plans have made it possible to define expectations and clearly specify design deliverables at the various design stages.

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While these developments have been extremely encouraging in the area of 3D design very little development has happened in the fields of 4D - linking time and scheduling data; and 5D - linking cost data to the 3D model. For instance the Veteran's Affairs (VA) BIM guide simply refers to a "4D BIM - phasing plan" and the "discretionary additional use" of "5D - Material take-offs and cost estimating".

For BIM to be truly successful in providing better buildings then all of the D's need to be embraced. This paper will concentrate on 5D and what it can do, so that open discussion can occur and as an industry we can shift to practicing 5D and shaping it as a standard practice for the future.

Change and reform in the construction industry is long overdue, the catalysts for change are here and these will be the accelerators that drive the BIM process to become the industry norm rather than the exception.

CATALYST FOR CHANGE

The Global Financial Crisis and world events have made development and construction uncertain. World thinking has changed our behaviours. For the first time in decades people are saving, credit cards are being avoided and there is a growing sense of frugality.

When a consumer decides to spend, it seems that a "saved" dollar is more valuable than a "borrowed" dollar and that a "saved" dollar won't be wasted. Today's consumers are extremely well researched and won't be rushed because there is no compelling reason to buy. There is no fear that prices will rise because competition is rife, in fact delaying the purchase may mean that the product gets cheaper.

So it makes sense to take the time, to be certain that the product is reasonably priced, is of the highest quality and is supported with a strong level of service.

Previously this delay or slowness to purchase was seen as a lack of confidence in the future – something that will pass but now there is a growing realisation that structural change is occurring and that these conditions are here to stay. There is a new paradigm in play.

For the development and construction industry it is particularly difficult to meet this paradigm because past experience tells us that construction is expensive and it is uncertain. Often a customer does not really visualise what is being built until it is built and there is an expectation that there will be delays and cost increases.

Successful building is about creating certainty - in design, buildability and cost. Wisdom, intelligence and technology can create certainty by getting back to basics and making grounded decisions based on facts.

BIM PATHWAY

At present projects can confidently be managed using a staged and independent process of inputting data into independent models with the parties collaborating but not integrating to use the software in a beneficial way. For example, architects can set their design, engineers can create the structural framework and air-conditioning contractors can submit their components all independent of each other using different authoring tools. Software, like Navisworks and Solibri, are then used to bring each model together to deliver a coordinated design.

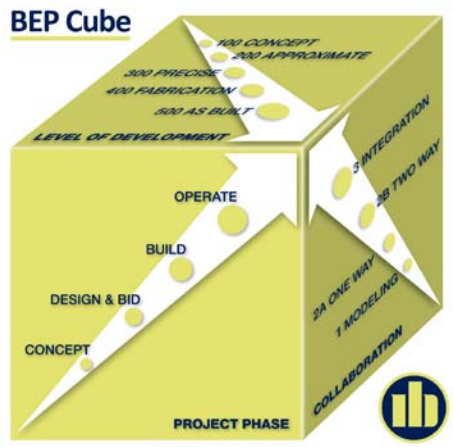
Andrew Gutteridge worked with the Australian Institute of Architects to champion the BIM pathway to provide a logical learning curve for the industry to move from

working in isolation to collaboration. The culmination of their work was production of a diagram "Towards Integration" which was later included within the CRC Construction Innovation publication - National Guidelines for Digital Modelling.

Using this diagram as a reference and applying it to the Australian industry, it was found that the mainstream uses 3D modeling in an isolated way (1B) and the cutting edge design teams are acting in a collaborative way (2A one-way and 2B two-way collaboration). Rather than spending time judging whether what is being done now is BIM or not BIM, it is far more important to acknowledge that industry is practicing and improving and that this is just part of the BIM pathway.

Industry design professionals are mostly engaged in the use of parametric modeling in one form or another but sceptics have a lack of trust in the software's intelligent design to fully integrate the model for each element.

Construction professionals also perceive a lack of protection of the input of information and data, if and when it is changed, by who and how it is tracked. What is important to remember is that even at 2A and B the duties and working practices for two dimensional work remain the same for three dimensional work.



At this point on the pathway it doesn't matter how you relate to parties throughout design, but rather that you do and that the obligations and design outcomes are clear.

Development of the BIM Execution Plan (BEP) has provided this clarity. The BEP defines the scope of design work, the Level of Development (LOD) and the two-way exchange of information for all parties to the project including the quantity surveyor (QS), cost engineer or estimator and can be clearly depicted on three scales – refer figure 1.

Figure 1. BIM Execution Plan Cube

CREATING COST CERTAINTY IN 5D

Developing certainty in cost, design and buildability reduces risk and creates better projects with sustainable profits. We know that 3D modeling and strong design coordination creates certainty in what is being built and that the 5th Dimension, or 5D, is all about cost. While there is considerable discussion and collaboration between different design partners often 5D is reduced to just the simple one liner of "Quantity Take Off" and attention is placed on coding by the designer with an expectation that later the costing process will be made easier.

This approach means that several opportunities are missed:

- The costs are not known until the model reaches LOD 300 or greater.
- The design itself is not tested at an early stage for functional efficiency or benchmarked against known elemental costs.
- There is no integrated cost plan and the design team is not provided with real-time cost feedback as the design progresses.
- The costing process is still a separate exercise which is not transparent.

An alternative and better approach is for the cost planner to push accurate cost codes into the model information and then to extract all of the information that is needed to complete a thorough cost estimate via a 5D BIM authoring tool. Part of this approach includes making allowances for work that has not yet or will not be modeled.

This approach means that all of the "missed opportunities" will be delivered and the result is a better building because the available money can be targeted at the most important features of the building design in a transparent way that builds trust amongst all project partners.

5D QS AND COST PLANNER

The modern QS is taking the traditional QS role to the next level, utilising models to provide detailed and accurate 5D estimates and living cost plans. This assistance is provided to projects at any phase from concept design through to construction and completion.

The ability to complete a series of estimates for various designs at the early phase of a project is paramount because this is when the dye is set, planning evolves and cost overruns are avoided. If the scope of a project matches the budget at the outset then constant redesign is avoided and the priority features of the project are included.

It is well established that early decisions have the highest level of influence on project outcomes at the least cost. This is because redesign, construction delay and disruption, change order and rework costs are avoided.

The technique is simple, basically an estimate is done, then its elemental costs are benchmarked and the functional performance of the design is analysed and tested against competing projects. The QS then provides feedback to the concept designers, a new scheme is produced and the process is completed again.

Once the project design passes this budget test and proving up phase then the Cost Plan is established for the project and this recipe becomes the basis for managing and monitoring the fluctuating construction costs during design.

A 5D QS can do this extremely quickly, an endless number of times and in a complexity of combinations. For a 2D QS this is not possible because project schedules do not allow enough time for endless manual take-offs and even if there was, then the re-measurement process is too labour intensive to be viable, the combinations that need to be considered are too complex and there are too many variables for a QS to complete the required "what if" style calculations manually.

The traditional process is to complete the design to a particular stage i.e. schematic design, developed design, etc.; then freeze further design until an estimate is completed and permission is granted to proceed to the next design stage.

Today there are modern techniques for the 5D QS to use within the traditional frameworks to set cost strategies and a 5D Cost Plan (or Living Cost Plan). These techniques can be blended within the traditional design and construction phases as follows:

CONCEPT DESIGN

At the feasibility and concept design phase, a cost strategy is set that considers all aspects of the project, the client's brief, the designer's vision and the site constraints. The strategy is developed after first completing a concept estimate and then testing its

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elemental costs by benchmarking and the design efficiency by analysing its functional performance.

Initial Concept Estimate – LOD 100

The initial concept estimate is a fast and effective way to determine the cost of a project and allow decisions to be made quickly and with certainty.

Working with the overall massing model (AIA LOD 100) in Sketchup, Revit or an IFC format, the 5D QS prepares a concept estimate that is presented in an elemental format and sets out each elemental unit rate and quantity. It is understood that not everything is modeled and the 5D QS uses experience to ensure that the total project is included within the estimate. This is done by supplementing the model information with 2D on screen measurement where necessary.

This concept estimate becomes the basis for recompiling the estimate to consider alternative designs during the proving phase of the concept design.

Elemental Cost Benchmarking

The 5D QS uses cost intelligence from past experience and actual project cost data to critique, review and compare the elemental costs contained in the initial concept estimate to other similar or competing projects. This exercise identifies inefficiencies and highlights opportunities that will benefit the project bottom line. Cost benchmarking is done on an elemental basis because this provides the most consistent results; examples of building elements include substructure, columns, upper floors, staircases, roof, external walls, etc and are fairly consistent around the globe. Some of the different elemental formats include UniFormat II (USA), UniClass (UK) or ACMM (AUS).

By way of example a concept estimate containing a rate of $354.90 per m2 for columns and upper floors would exceed the actual average costs of $279.09 per m2. If the design is made more efficient a cost saving of 3.6% against the estimated total building rate of $2,078.57 per m2 is achieved.

Analysis of Functional Performance

In a similar fashion the functional performance and efficiency of a building is analysed against actual project performance data to further identify inefficiencies and highlight opportunities to create further savings.

	Planned Project Concept Design	**Actual Completed Projects (Average)**
Residential Area / Unit	98.5m^2	65.3m^2
Common Area / Unit	30.9m^2	11.6m^2
Carpark Area / Unit	39.5m^2	25.0m^2
Building Area / Unit	**168.9m^2**	**101.9m^2**
Residential Area / Unit	98.5m^2	65.3m^2
Balcony Area / Unit	33.5m^2	12.9m^2
Saleable Area / Unit	**132.0m^2**	**78.2m^2**

Table 1: Functional Performance Analysis

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In Table 1, the example concept design for a planned apartment building contains 36 apartments with an average area of 168.9 m2. This exceeds the completed project average of 101.9 m2. It is also apparent that much of the inefficiency is occurring within the common spaces and car park areas which are not income producing. Correction of these inefficiencies would improve the building cost performance by 20% without effecting the saleable area and income.

DETAILED DESIGN

At detailed design, the goal of the 5D QS is to produce a schematic design estimate with dynamic links to the model information that will form the foundation for the living cost plan that is used for developed design and bidding. The living cost plan becomes the basis for providing updated estimates every time the model information is changed that can be used for forecast final cost, budget variances, value management, finance, funding and final investment decisions or in negotiations with a contractor.

Schematic Design – LOD 200

Working with the schematic design model (AIA LOD 200) in Revit or IFC format, the 5D QS prepares a sketch design cost plan that is presented in an elemental format stating the generic construction materials, finishes and services specifications.

The 5D QS maps the model and adds an elemental pricing code to the model information. It is helpful if the author has included UniFormat II (USA), UniClass (UK) or ACMM (AUS) codes in the model information but often it is much quicker and more accurate if the 5D QS adds the preferred codes for the task.

Dynamic links are then created between the generic architectural and structural model elements, the 5D QS elemental rate library and the selected project template that is contained within the 5D BIM authoring tool such as CostX.

It is understood that not everything is modeled and the 5D QS ensures that all of the work is estimated by supplementing with 2D on screen measurement where necessary. Trust and transparency is supported by providing a fully functioning and executable CostX reader version of the sketch design cost plan that is easily interrogated because of the dynamic links between the models, elemental areas and rate library. This executable file becomes the basis for the living cost plan which can be recompiled to consider alternative designs, different construction methods, materials and generic engineering systems during development of the schematic design and any time the model information is revised.

Developed Design – LOD 300

Working with the developed design model (AIA LOD 300) in Revit or IFC format, the 5D QS prepares developed design cost plans that are presented on a sub-elemental and trade basis, stating the specific construction materials, finishes and services specifications. The final estimate states each sub-elemental unit rate and quantity.

At this stage an extra level of costing detail is added to the model information. This can be done via key notes and then the model is re-mapped where necessary to create further dynamic links between the specific model assemblies (including architectural, structural, civil and MEP), the detailed rate library and the selected project template that is contained within the 5D BIM authoring tool. Again the model information is supplemented with 2D on screen measurement and the executable file continues to be the living cost plan This detailed information can factor into the different stages of the

design and construction process and helps to consider in detail the labour, materials, equipment, and subcontractor costs for each building element.

Coding
In circulation today there are a number of different coding systems but there is not a published industry code that is suitable for becoming a price code which will automatically link a rate to a specific system or assembly. UniFormat II is one example and while it is close to achieving this goal it has insufficient levels to specifically identify the material and fixing condition. For these reasons the 5D QS uses its own specific code for the material and fixing conditions which is pushed into a model as a key note.

QUANTITY TAKE-OFF AND BIDDING

For design, bid, build procurement the rate library is removed from the executable file so that what remains is a bill of quantities that is easily interrogated by contractors and subcontractors because the dynamic links allow each quantity to be viewed in the model. The file is also recompiled in a trade format so that the quantities reflect the scope for each subcontract. Often the building information comprises individual models and the 5D QS uses tools like Navisworks and Solibri to coordinate visually. MEP forms approximately 30% of the total project cost so special care is needed during this phase to ensure that quantities for mechanical, electrical, hydraulic, fire and transportation services are actively coordinated with the building trades.

CONSTRUCTION

Contractors Priced Bill of Quantities – LOD 300
Working with the construction model (AIA LOD 300) in Revit or IFC format, at the commencement of construction, the 5D QS attaches the contractor's offered rates and prices to the executable file. The contractors priced bill of quantities is presented on a trade and zone basis and states the description for each item (including the specific construction materials, finishes and services specifications), the quantity and the offered rate. In some instances re-mapping of the model is necessary to create further dynamic links between the model zones and specific assemblies.

Change Orders, Variations and Payments
The dynamic links mean that variations and change orders can be calculated reliably, easily and quickly every time a change occurs in the model information. Progress payments are also calculated from the executable file by isolating the completed zones by trade and recompiling the quantities to produce a progress payment calculation that is transparent and easily interrogated.During construction the model will evolve from LOD 300 to LOD 400 as changes occur on site and shop drawings are developed. The 5D QS continually coordinates the construction model with the contractors priced bill of quantities and provides cost updates, budget performance and variances through each stage of construction.

Cost Integrated Construction Model – LOD 400
As construction progresses the model information is changed to produce the revised documents that are necessary for the construction process – this information is stored in the Model software. The 5D QS also changes the cost information to reflect the actual contract sum and any cost adjustments and payments that occur during construction – this information is stored in the 5D BIM authoring tool.

As-Built Cost Data & Facilities Management – LOD 500

Once validation and synchronization is completed between the as-built (AIA LOD 400 or 500) Model and the FM system, The 5D QS pushes the project as-built cost data into the Model key notes. The as-built cost data packet usually comprises several different pieces of information including the replacement cost at the base date, manufacturers expected life for replacement, effective life for depreciation and estimated running cost for operating budgets. Care is taken to omit construction costs that will not be incurred again such as demolition of pre-existing buildings.

This as-built cost information is then ready to be integrated into the Facility Maintenance System and FM database for use throughout the life cycle of the project.

CONCLUSION

The 5D QS has developed specialist technology skills which compliment traditional cost planning techniques that set strategies from preliminary designs when plans evolve and cost overruns are prevented. 5D BIM provides the ability generate savings and efficiencies and to drive costs for buildings, infrastructure, heavy engineering or land development in the direction that is wanted. When negotiating with contractors and subcontractors the ability to visualise quantities creates trust and is relied upon.

5D BIM is here and finally there is traction to make 5D an integral part of the QS tool kit and every project to create cost certainty. It is one thing to use the technology but on its own it will not generate the certainty that customer's desire.

This requires the wisdom and intelligence of a 5D QS and cost planner. So while it's the way of the future and a must for all projects going forward, it is critical to work with people who know what they are doing and know how to leverage it to get the best results for the building from initial concept through to procurement and on-going management of post construction.

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UK GOVERNMENT BUILDING INFORMATION MODELLING (BIM) STRATEGY

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ABSTRACT

The UK Government's construction strategy is committed to deliver a structured Government/Industry capability to increase BIM take-up over a five year horizon as part of a joined up plan to improve the performance of the government estate in terms of its cost, value and carbon performance. The strategy was announced in June 2011. The strategy requires the Government to clearly define the data that it requires from the BIM while leaving the industry to take responsibility for the BIM infrastructure. The Government has started to run pilot projects and gain some first hand experience of the benefits while fleshing out the detail of its requirements. The industry is keen to respond particularly those firms that work for Government departments. The use of BIM tools has been patchy and have tended to be 'lonely BIM' used by individual consultants and contractors to improve their performance rather than 'project BIM' that will improve performance of the team through collaborative working.

Key words: Building Information Modelling (BIM), Procurement, Information management, Collaborative working.

INTRODUCTION

An industry working group was invited by The Department of Business Innovation and Skills (BIS) and the Efficiency Reform Group from the Cabinet Office (ERG) to look at the construction and post-occupancy benefits of BIM (Building (asset) Information Modelling and Management) for use in the UK building and infrastructure markets.

THE PAPER DESCRIBES THE WORKING GROUP'S RECOMMENDED STRATEGY, WHICH HAS BEEN ADOPTED BY THE GOVERNMENT. THE OBJECTIVE IS TO DELIVER A STRUCTURED GOVERNMENT/SECTOR CAPABILITY TO INCREASE BIM TAKE-UP OVER A FIVE YEAR HORIZON AS PART OF A JOINED UP PLAN TO IMPROVE THE PERFORMANCE OF THE GOVERNMENT ESTATE IN TERMS OF ITS COST, VALUE AND CARBON PERFORMANCE.

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THE REPORT

Issues, Barriers and Solutions

The Working Group set up nine sub-groups to look at individual issues whose reports make up the Appendices to the strategy report.

- Digital capabilities
- Legal, contractual and insurance
- Delivery standards and processes
- Education, training and support
- Improved information handover
- Information use and benefits
- Communications and Institutional support
- Investment
- Programme

There is a target for all suppliers of construction services to Her Majesty's Government (HMG) to have reached the ability to deliver information and services of at least that of Level 2 in the maturity model (see below).

Next Steps

The strategy calls for the setting up of:

- cross-government 'implementation and mobilisation' Task Group to include local and regional government to
  - Identify current capabilities
  - Consider information needs to ensure consistency and clarity to supply chain
  - Find demonstration projects
- a client/industry group to develop a funded mobilisation plan to include:
  - Creation with British Standards Institute of a deliverables framework
  - Tailor COBie methodology
  - Create metrics to monitor outcomes
  - Consider contractual requirement

The Hypothesis

Rather than define BIM it sets out a hypothesis and a number of tests to guide and validate the proposed strategy focussed on the outputs of BIM. The hypothesis is:

> 'Government as a client can derive significant improvements in cost value and carbon performance through the use of open shareable asset information.'

The tests are that the BIM implementation should be:

- Valuable
- Understandable
- General
- Non-Proprietary
- Competitive
- Open
- Verifiable
- Compliant

BIM Maturity Model

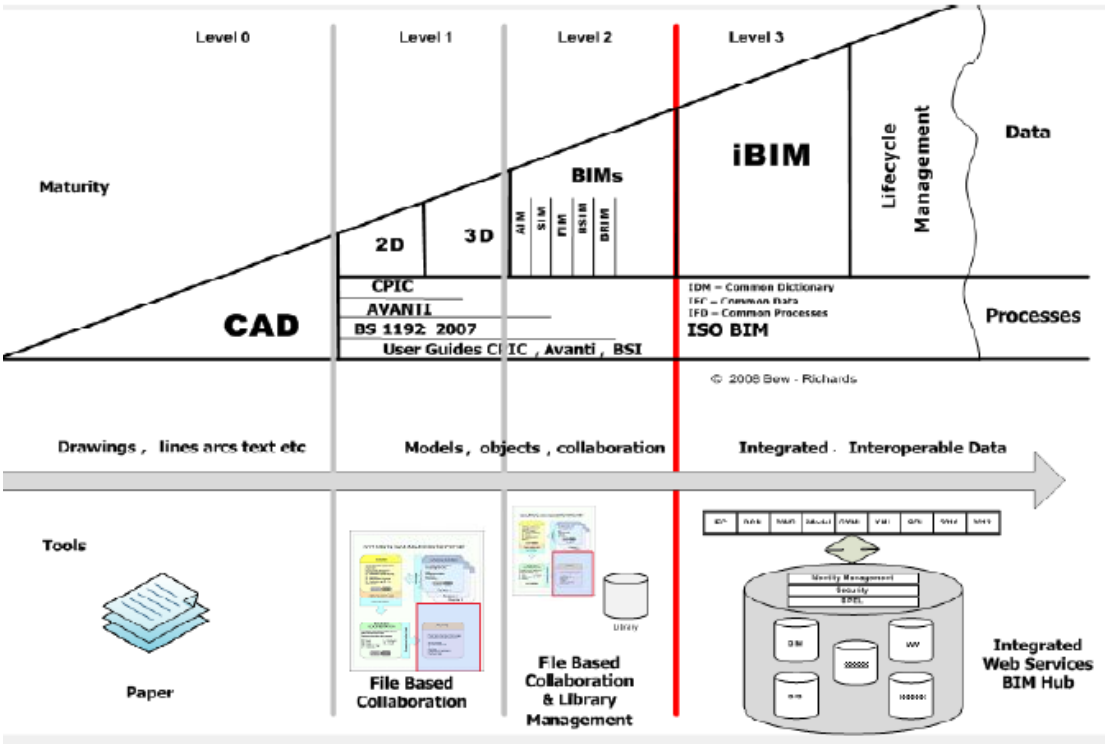
Defines the competence and delivery from a BIM. It illustrates it with the 'Wedge' diagram that has become the industry standard. See Figure 1.

The levels are defined as:

0. Unmanaged Computer Aided Design (CAD) probably 2D with paper (or electronic paper) as the most likely data exchange mechanism
1. Managed CAD in 2 or 3D format using BS1192: 2007 with collaboration tool providing a common data environment, possibly some standard data structures and formats. Commercial data management by stand alone finance and cost management packages with no integration.
2. **Managed 3D environment held in separate discipline 'BIM' tools with attached data. Commercial data managed by an ERP. (Note: 'Enterprise Resource Planning' software) Integration on the basis of proprietary interfaces or bespoke middleware could be regarded as 'pBIM' (proprietary). The approach may utilise 4D programme data and 5D cost elements as well as feed operational systems.**
3. Fully open process and data integration enabled by 'web services' compliant with the emerging Industry Foundation Class/International Framework for Dictionaries (IFC/IFD) standards, managed by a collaborative model server. Could be regarded as iBIM or integrated BIM potentially employing concurrent engineering processes.

To get the industry to Level two in five years is the Government's target.

Figure 1 – BIM Maturity Model



Source: Strategy Paper for the Government Construction Client Group From the BIM Industry Working Group –BIS, March 2011

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International Alliances
The working group established relationships with established BIM experience elsewhere particularly within the American Government - US Federal Facilities Council, the US National Institute of Building Science (NIBS) and the General Services Administration (GSA).

Legal, Contracts and Insurance
The working group addressed the following issues covering:

- Copyright and Intellectual Property (IP)
- Ownership and sharing of data
- Insurance and liability
- Integration with existing contracts
- Commercial issues- procurement practice, approval and payment
- Maturity model – prioritisation for developments.

The conclusions include:

- That IP will not be a barrier to BIM adoption.
- That BIM competence should be a pre-qualification issue and not part of the selection and appointment process..
- Simple standard contracts amended should be produced requiring BIM compliance.
- Establish standard protocol setting out consistent requirements for project delivery and outputs.
- Define duties for consultants and contractors working in a BIM environment.
- Define duties for the new role of 'model manager' and relationship to others.
- Clients should expect ***'Quantity Surveyors (QS) and Project Managers to be familiar with BIM and actively develop ways in which processes can be made more cost effective and value adding'***.

There is a section on integration of cost management and programme outputs into a BIM model, which states:

'Much BIM software is capable of producing "schedules of quantities" and enabling the Construction sequence to be simulated prior to construction. This capability would suggest that Cost Management and Programming activities can be readily brought into the BIM environment – particularly at earlier stages of design development. However, the effective adoption of BIM technologies by cost consultants and planners has been slow to date, and should this situation remain, then cost and programme services will not benefit from the productivity and speed of response that a settled BIM process can offer. This is not to say that the adoption of BIM will not be without its challenges, but that the ***professions cannot afford to be outside of the BIM loop.'***

It also states that ***'methods of measurement and duties may need to be reviewed to ensure that the appropriate information is produced so that measurement can be automated to a greater degree…Measurement will be accelerated but discretionary skills will still be necessary.'***

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Process and Documentation
The report sets out the standards and guidance required to deliver the strategy. British Standards Institute (BSi) B/555 is identified as the key producer of guidance, with a third party, potentially the Construction Project Information Committee (CPIC), producing the guidance required to deliver level 2 documentation. It details the BSi, International Organisation for Standardization (ISO) and other standards available and under development.

Education and Training
The report identifies the requirement for training graduates and current industry practitioners and the role that universities and Institutions will have in raising awareness and delivering training. Including the requirement for Institutions to encourage BIM capabilities to their membership

Identifies the need for training and education to support:

- Awareness
- Provide guidance and toolkits
- Technical skills
- Non-technical, ancillary skills
- Accreditation
- Review and benchmarking
- Post project evaluation

BIM Deliverables
The information required on a capital project is identified at each stage of the Office of Government Commerce (OGC) project gateway.

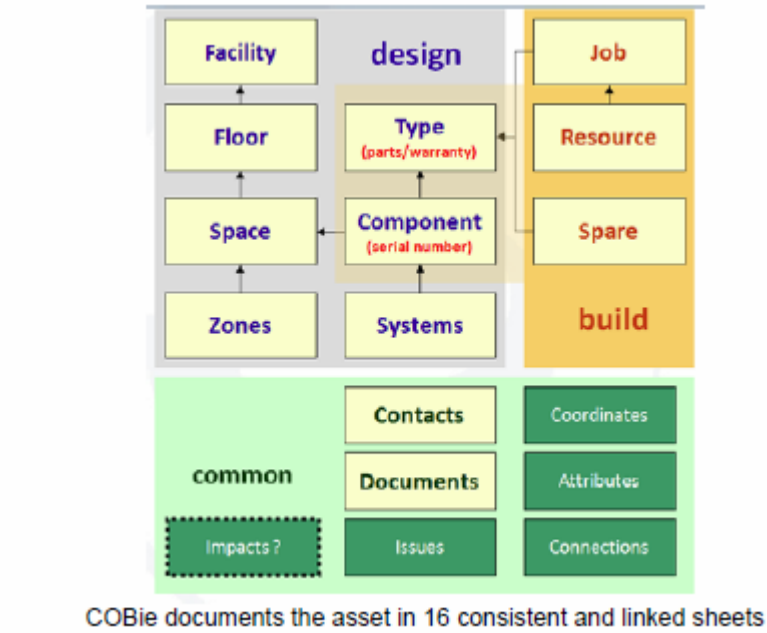
It identifies when costs are required and what information will be available at these stages. It alludes to Life Cycle Cost and carbon data but does not cover output to Facilities Management. The data requirement needs to be mapped to the 'COBie data definitions'.

COBie stands for 'Construction Operations Building information exchange'. It is a means of sharing, predominantly non-graphical, data about a facility. It was developed in America and will need to be adapted for use in the UK and in Infrastructure. It is a non-proprietary format based on a spreadsheet so it can be managed by organisations of any size at any level of IT capability but can be linked to other systems and software. See Figure 2.

COBie transfers information to owner/occupier to manage their assets efficiently. It documents the asset in 16 linked spreadsheets.

COBie will be adopted as the standard means of reporting data from a BIM. Reporting at specific stages is referred to as a 'COBie data drop'.

Figure 2 – COBie format



Source: Strategy Paper for the Government Construction Client Group From the BIM Industry Working Group –BIS, March 2011

Handover Information

The report details how handover can be improved by delivery of consistent data through COBie, but that it requires localisation for UK to support carbon related decision-making and extended to accommodate infrastructure owners.

Implementation relies on three primary functions:

- **Gathering** asset information
- **Maintaining** the information
- **Using** the information

The data to be provided (data drops) are identified at four key stages of a capital project mapped to various process maps used in the UK, e.g. Royal Institute of British Architects (RIBA) plan of work, Office of Government Commerce (OGC) Gateways, Network Rail's Governance for Railway Investment Projects (GRIP) stages, etc. The Key stages are identified as:

1) To check design brief against clients brief and provide cost plan and risk management
2) To check tender design against project brief, cost plan, environmental requirements and provide tender transparency
3) To check detailed design and contract packaging for scope, cost and carbon
4) To provide and check handover data, actual cost, actual programme, actual carbon performance.

Caveat

'The key principle of the strategy is that the Construction Industry will respond to the opportunity created by government with innovation and solutions, the Government Construction Client should anticipate some inertia, should aim to encourage a single voice in the industry and be prepared to manage the outcomes of the initial development work streams.'

EVIDENCE OF IMPROVEMENTS RELATING TO BIM

The first UK Government pilot projects procured with a project BIM in accordance with the strategy are yet to report costs and savings, but what evidence there is to savings resulting from the use of BIM tend to relate to the use of BIM by individual participants in the process; consultants or contractors, 'lonely BIM' as distinct from a 'Project BIM' used by all participants.

For example:
A Stanford University report (Gao and Fischer, 2008) based on 32 projects showed:

- Up to 40% elimination of unbudgeted change.
- A savings of up to 10% of the contract value through clash detections
- Up to 7% reduction in project time.

And a report by Holder Construction (Himes and Steed, 2008) on an individual project showed:

- $90k cost of BIM
- Identification of 590 M+E clashes
- Savings of $800k

CONSTRUCTION COST MANAGEMENT AND BIM

There is an on going dialog between BCIS and the BIS implementation team about classification of costs and measurement rules to be adopted in the data drops.

In many cases a budget expressed as an elemental cost model will be prepared as part of a business cases, before the BIM is set up. Therefore as the model is developed it needs to support the measurement required to report costs against the budget in an elemental form.

For the QS to reap the efficiency benefits from the BIM process measurement rules and cost reporting requirements need to form part of the client's 'Employers Information Requirement' for BIM.

CONCLUSIONS

The strategy is described as 'Push-Pull'. 'Push' being things that the supply side of the industry should do to facilitate the use of BIM and 'Pull' being the requirements that the client side needs to demand to specify, collect and derive information to add value.

The time scale for the strategy is five years.

There are six key recommendations summaries as follows:

- Make the supply side responsible for the BIM infrastructure.
- Client contract requirements for deliverables and responsibilities must be clear and specific.
- Client must use the required information and be transparent as to how it influences key decisions in both delivery and operational phases of a project.

- A level of investment will be required to provide the infrastructure but the technology need be no more complex than systems already in use by the industry.
- Changes in requirements should be made in small but significant steps.
- The Governments target is for all projects to deliver information at the 'level 2 of the maturity model' (i.e. from 3D models for separate disciplines (architecture, structural, services, FM etc) together with programme data an costs) within the five-year horizon. - ***But never underestimate the power of inertia!***

The clients 'Employer's Information Requirements' need to include requirements measurement and cost reporting.

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STAKEHOLDER MANAGEMENT AND CORPORATE CULTURE IN THE UK CONSTRUCTION INDUSTRY

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ABSTRACT

Traditionally stakeholder management and corporate culture have been seen as two very different knowledge areas. It is important for this study to investigate the two within the context of the UK construction industry and attempt to generate a framework that demonstrates the dependency of each on the other. The wider research project employed both qualitative and quantitative research methods, including semi-structured interviews, cognitive mapping and questionnaire survey. This paper will specifically present some of the quantitative results as well as theory generated by the study. The data suggests that stakeholder management and corporate culture are key areas of an organisation's success, and that this importance will only grow in future. In addition, it was discovered the UK Construction Industry has not yet fully accepted stakeholder theory. Evidence of a relationship was established between the two theoretical areas and a framework developed and quantified. It is evident that change is needed within the UK construction industry. Companies must employ ethical and social stakeholder management and manage their corporate culture like any other aspect of their business. Successfully doing this will lead to more successful projects, better reputation and survival. The findings of this project begin to show how change may occur.

Keywords: corporate culture, framework, stakeholder management, theory, UK construction.

INTRODUCTION

According to Jongbloed et al. (2008) the current application of stakeholder management in theory comes from the Stanford Research Institute which in 1963 used the term to expand the belief that shareholders were the only group management needed to be concerned with (Mainardes et al. 2011). The term stakeholder first came to light in the business world with *Strategic Management: A Stakeholder Approach* written by Freeman in 1984. The concept took even greater importance given public interest, media influence and ethical concerns about the conduct of businesses (Mainardes et al. 2011).

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In recent years construction companies have realised that it is important to fully embrace 'stakeholder theory' due to the increasing diversity, power and influence of stakeholders. Within the UK construction industry project success has become measureable by more than profit and client satisfaction. Companies are now expected to deliver projects with social value, sustainability and consideration of all stakeholder needs.

Corporate culture, meanwhile, is 'a set of morals, values, attitudes, beliefs and meanings that are shared by the members of an organisation (Williams, et al. 1993.) As such, it influences the way in which a business conducts itself. Culture allows business to differentiate itself from others, but still remains one of the most difficult aspects of business to understand. According to Schein (1985), if the construction industry is to become more efficient and effective it must understand the role culture plays. Ankrah and Proverbs (2004) suggest that culture has been used as the 'black box' for many of the construction industry ills. They argue that this is unfair given the lack of research into the area.

This particular study aims to investigate current stakeholder management practices and corporate culture norms within the UK construction industry and to generate new theory that links the two, with qualitative and quantitative data to support the proposed framework. We will be able to determine whether the UK construction industry has embraced stakeholder theory and whether a relationship exists to corporate culture.

Stakeholders

Freeman (1984) defined stakeholders as 'groups or individuals who can have effects on, or are affected by, the objectives of an organisation.' Starik (1994) refined this saying that stakeholders could also be those who are, or could be, influenced by or could themselves influence an organisation (Kolk and Pinkse 2006). It is widely accepted that stakeholders have a claim or interest in a project and its activities (Nguyen et al. 2009; Mitchell et al. 1997; McElroy and Mills 2007).

Many parties have been identified as stakeholders, from both within and outside of a firm's direct operations. Project managers, site personnel, contractors, sub-contractors, local government, communities, media and professional bodies have all been cited as possible stakeholders (Newcombe 2003; Ward and Chapman 2008; Chinyio and Akintoye 2008).

Stakeholder Management

According to Jones and Wicks (1999) and Savage et al. (2004) there are numerous basic principles of stakeholder theory. Firstly, the organisation enters into relationships with many groups that are impacted on or have the ability to impact on an organisation (Mainardes, et al. 2011). Stakeholder management is about understanding the nature of these relationships.

Modern procurement methods have led to a higher number of stakeholders for construction projects to contend with. The very existence of relationships means stakeholders need to be managed. Chinyio and Akintoye (2006) suggest that a number of stakeholders mean that participants are not always going to be in agreement. The

different interests represented can influence and at times threaten projects (Freeman 1984; Cleland 1999).

Likewise, Cleland (1999) suggests that success in construction projects is significantly dependent on meeting the needs of stakeholders. Bourne and Walker (2005) attribute many project failures to poor consideration of stakeholder needs. In their study of public-private infrastructure projects, El-Gohary, et al. (2006) claim that stakeholder input is crucial. Waddock et al. (2002) suggest that stakeholders need to be managed due to pressures not only from stakeholders themselves but because of social trends and institutional expectations, as well as serious ethical and legal obligations.

Stakeholder management approaches

Smyth (2008) suggests that the most common form of stakeholder management used in construction is utilitarianism. This approach is largely concerned with maximising the utility of a firm in terms of profit and growth. Newcombe (2003) agrees with this, suggesting that there is a 'Machiavellian approach' to stakeholder management that is more pragmatic than ethical. He suggests that a more 'Kantian approach' will become the norm where the project will be managed to the benefit of all stakeholders and trusting relationships will be formed.

By the same token, Bourne and Walker (2005) believe stakeholder management should be approached in a corporately responsible way. Part of this, they state, is to adapt a sustainable approach to projects while simultaneously learning and innovating. On the other hand, Kolk and Pinkse (2006) describe 'stakeholder mismanagement,' characterised by a lack of moral responsibility.

Corporate Culture

The mostly widely accepted definition of corporate (organizational) culture is given by Schein (1985). He describes it as a pattern of shared assumptions that a group learns from the successful confronting of problems. He indicates that this can then be taught to new members of a group as the correct way to feel and face problems.

The meaning of culture will differ depending on a number of factors such as industry, business or leadership. Zabid and Rashid (2003) suggest that while numerous definitions of culture exist, it is seen as holistic, historically determined and socially constructed by all. Despite the clear importance of culture, Williams et al. (1993) say that little attention is given to the practical procedures of managing culture.

Zabid and Rashid (2003) suggest that management and leadership style are important aspects of any company. This view argues that leadership and not simply management is important to establish a strong and positive culture. Many academics suggest that another internal stakeholder, the employee, is an important driver of culture within an organisation. Zabid and Rashid (2003) concur, citing in particular that employees' attitude and behaviour as vital factors.

The Importance of Corporate Culture

Schein (1985) indicates that culture is important because it is a powerful, latent and mostly unconscious force that impacts on the behaviour of those within a company. Assessing it allows managers to better understand their company and how to improve,

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responding to the business environment. Schein (1985) further suggests that culture is one of the last mechanisms that the companies within the construction industry have available to improve their competitiveness.

Cameron and Quinn (1998) developed the Competing Values Framework in an attempt to classify culture types. Within this model four culture types were identified; hierarchy, market, clan and adhocracy. Each of these cultures displays their own characteristics. In order to assess the dominant orientation of an organisation the Organisational Culture Assessment Instrument (OCAI) was developed (Oney-Yazici 2006). Based on these studies, Fig. 1 represents the culture types considered further in this research.

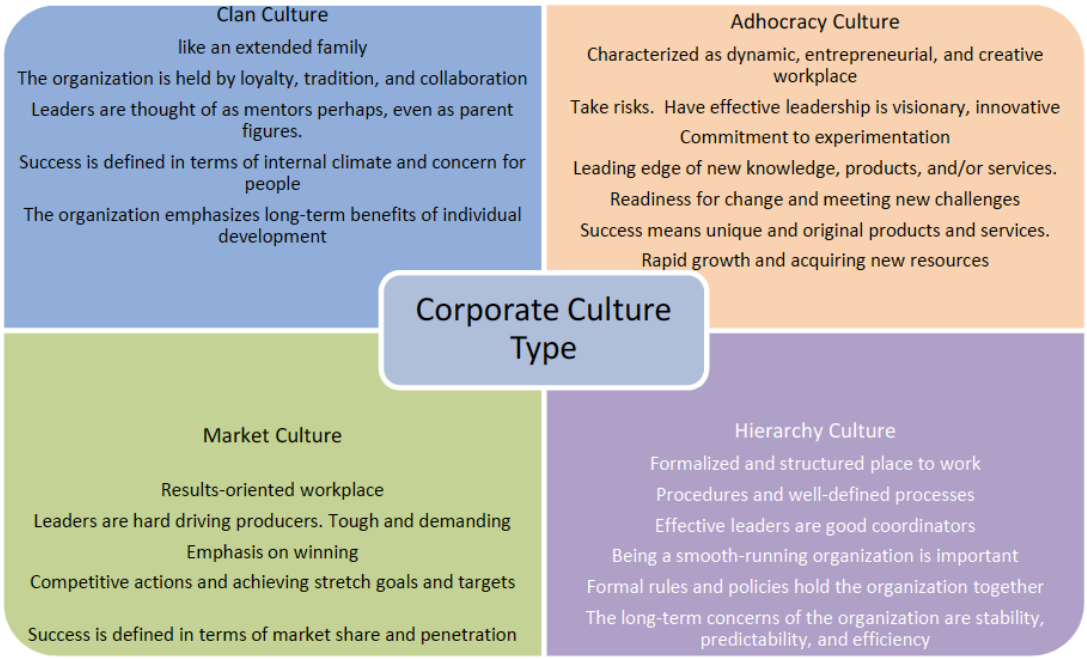

Figure 1. Culture types. Source: authors from Cameron and Quinn, 1998 and Oney-Yazici 2006

The primary reason that culture influences and impacts on stakeholder management is that culture guides the behaviour of those in the company (Galbreath, 2010). As Schein (1985) found, culture is one of the main ways that social organisations are connected to their environment.

METHODOLOGY

This paper examines some of the quantitative findings and theory development to emerge from a mixed-methods study conducted in 2011. 5 exploratory interviews were conducted with internationally experienced construction professionals and the information resulting was combined with existing knowledge based on previous literature to produce a questionnaire survey.

The questionnaire investigated both culture types within UK construction firms and prevalent stakeholder management approaches. 300 requests were made for participation via email and 45 responses were received for a 15% response rate.

FINDINGS

Fig. 2 shows in the second column the distribution of culture types within the UK. According to this research the construction industry is made up of three main culture types (90%). Type A, the clan culture; type C, the market culture and type D, the hierarchy culture. Type B, the adhocracy culture was less present within the industry, according for only 10% of the sample. This would suggest that the UK Construction industry culture quite possibly lacks entrepreneurial, creative and innovative characteristics.

The fourth column shows how the four stakeholder management extremes are represented within the UK construction industry. Sixty-six per cent of companies claim that their stakeholder approach is dominated by stakeholder management extreme 1, the Ethical and Social approach. It is interesting to note that all professionals surveyed confirmed that they practiced some form of stakeholder management.

However, these results also show that 34% of the industry falls into stakeholder extreme groups 2 and 3; the utilitarian positive and negative approaches respectively. This implicates that just over one third of UK construction companies put self-interests and economics ahead of stakeholder interests.

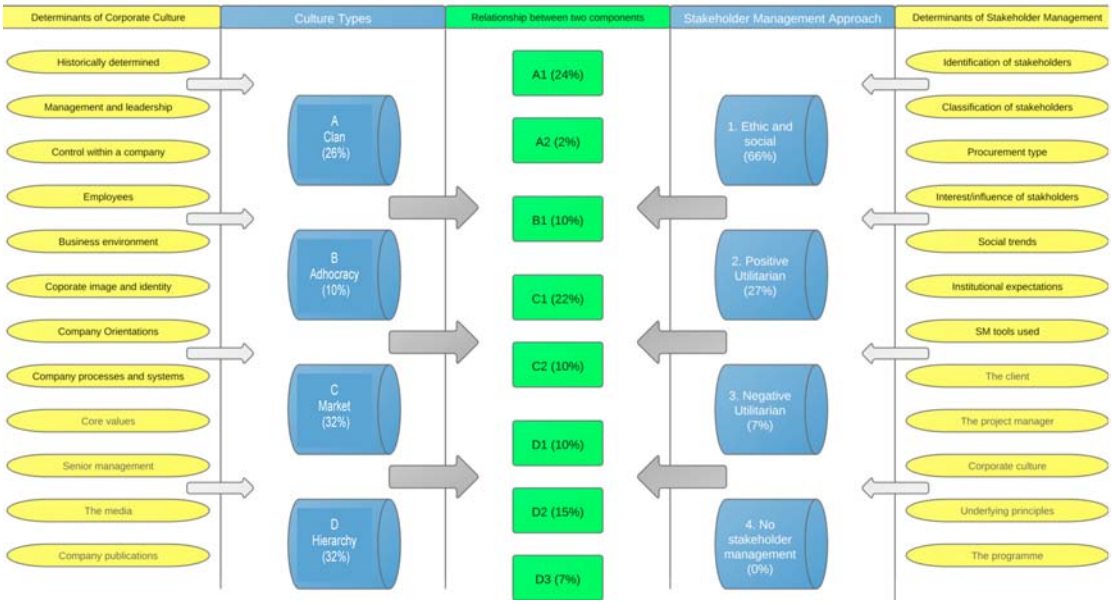

Figure 2. Stakeholder Management/ Corporate Culture Framework in UK. Source: authors

It can be seen from the framework that the UK construction industry is dominated by organisations of clan (A) and market (C) culture types, approaching stakeholders in an ethical and social way (approach 1). Interestingly it can be that the seven per cent that fell into stakeholder approach 3 (negative utilitarian) also fall into culture type D, the hierarchy culture. Perhaps it is their formalised and well-defined processes that contribute to this. Such companies often show resistance to change and perhaps this is why stakeholders are approached negatively.

DISCUSSION

This research found that the UK construction industry believes that stakeholder management that helps deliver profit and growth is the most successful, and this carries certain dangers. Many companies put self-interest above all else and this can seriously impact stakeholder management, hindering optimum results. There are many benefits to a more inclusive stakeholder approach, including long-term relationships and improved corporate image and reputation.

For the UK construction industry corporate culture is the ethos, beliefs and behaviours of an organisation. Furthermore it describes the systems and processes used to conduct business. Most employees that discussed this research described their organisational culture as good and this suggests that organisations within the UK industry appoint individuals that match their culture type. Alternatively, perhaps employees are drawn to companies that have a similar belief system to themselves.

As discussed earlier within this research corporate culture within the construction industry was determined based on a set of four typologies; clan, adhocracy, market and hierarchy culture. The research suggests that there is a healthy mix of these culture types within the UK construction industry. The market and hierarchy types were most prevalent. This indicates that the UK construction industry is mostly made up of companies that are results orientated, that aim to be the market leader and outpace their competition; and on the other hand organisations who are very formalised and structures and are driven by well-defined procedures and processes.

As Galbreath (2010) suggested, the primary reason that culture influences and impacts on stakeholder management is that culture guides the behaviour of those in the company. The questionnaire allowed for the idea of a relationship to be tested within the UK construction industry based on the stakeholder approaches and corporate culture types that were determined. Evidence was found of a relationship between the two theories. For example, clan culture almost entirely corresponded with ethical and social stakeholder management. Given this culture is described as being family-like and that success is defined in terms of people perhaps this is unsurprising. Likewise, adhocracy culture recorded entirely ethical and social stakeholder management scores. However, unlike clan culture, this culture is typified by innovation and risk taking. Perhaps, this willingness to engage new ideas and readiness for change explains why these firms approach stakeholders in an optimal way. This research has highlighted the growing importance of stakeholders within the construction industry; it appears that given the dynamic attributes of adhocracy culture they have been able to clasp this significance and stakeholder management effectively.

Market culture also correlated largely with ethical and social stakeholder management; however some positive utilitarian approach was also present in the findings. Market culture's strong stakeholder performance may be attributed to a competitive nature and emphasis on winning. Notably these characteristics can on occasion lead to a utilitarian approach. Being very results orientated may suggest that companies would act in self-interest, yet it was found that an ethical and social approach was common. This seems to suggest that ethical and social stakeholder management is also best for a company's interest and will deliver better results for the company. Unlike the other stakeholder typologies hierarchy culture does not approach stakeholders in an ethical and social manner. Hierarchy culture is dominated by

positive utilitarian stakeholder management; this is to say that their interests are put first.

Given the prominent features often associated with this culture type it is conceivable that this is an unintentional outcome. Due to the structured and process driven approach of hierarchy culture, maybe this approach is due to habit more than anything else. There are no obvious reasons apart from this why hierarchy culture would approach stakeholders in this way. Possibly it is their reluctance to embrace change and unwillingness to take risks that lead to this stakeholder approach.

It is evident from the findings that many companies within the UK construction industry must address issues within their stakeholder management approach. Given the relationship demonstrated between stakeholder management and corporate culture this may implicate that these companies must also change their corporate culture. On an individual organisational level, a better understanding and management of business processes and behaviours is essential.

CONCLUSIONS

It is obvious from this research that stakeholder management and corporate culture are important considerations for the UK construction industry and will increase in stature with time. However, the problem remains that the construction industry has not yet fully integrated a stakeholder agenda that takes this into consideration. This needs to change if the industry is to improve its performance and reputation.

In addition, as Williams et al. (1993) found there is too little consideration given to the day-to-day management of culture. It has been described by many as the primary way an organisation can distinguish itself from another and also represents one of the last sources of competitive advantage (Schein 1985; Lin and Lai 2008).

UK construction firms must employ a long-term perspective and realise the ways the industry is changing, and that acting now will ensure long-term survival. This research suggests that companies can address problems with corporate culture alongside stakeholder management in future given the clear links that have been established.

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LEGAL AND REGULATORY ISSUES CHALLENGING THE PAKISTANI CONSTRUCTION INDUSTRY

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ABSTRACT

The Pakistani construction industry suffers many of the same pains as that of a developing country. Corrupt governmental involvement and lack of regulatory constraints allow ill-qualified consultants and contractors to structure the industry to suit their purposes. To continue leveraging on domestic opportunities and competing in the global marketplace, Pakistani construction industry players need to address these challenges. Improvements need to be implemented by all parties along the entire construction industry value chain for lasting transformation to occur. The absence of a strong regulatory environment and authority is a problem that requires priority attention. Structurally weak legal and regulatory framework acts as a deterrent for attracting qualified consultants and contractors. To present a construction opportunity that will appeal to ethical and competent companies of both national and foreign ownership the Pakistani construction industry must provide an improved business environment.

Keywords: business, ethics, legal, Pakistan, regulations.

INTRODUCTION

This paper is founded upon the findings of a study performed by NED University of Engineering and Technology and Florida International University. The scope of the study was targeted toward identifying the key issues related to – and developing a strategic model for improvement of – construction project management framework in Pakistan, the findings of the study were more concentrated on identifying the gaps in construction project management education, research and practice in the industry. However, while diagnosing these specific issues, a number of macro-level industry issues in relation to the overall business and operational environment of the construction industry of Pakistan, in general, were also identified and noted. Two of the authors of this paper have an in-depth knowledge and understanding of the Pakistani Construction Industry through many years of work experience and consulting.

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Of the multitude of macro-level topics revealed those listed below will be discussed herein:

- Construction industry business environment
- Construction industry regulatory environment
- Construction industry legal environment
- Ethical behaviors in the construction industry

To continue leveraging on domestic opportunities and competing in the global marketplace, Pakistani construction industry players need to address these challenges. Improvements need to be implemented by all parties along the entire construction industry value chain for lasting transformation to occur. Therefore, in addition to contractors all of the other participants in a project such as public clients, approving authorities, consultants, and other stakeholders must be involved in this transformation.

Construction Industry Business Environment

Political interference, corruption, transparency, and security issues are among the major impediments to the growth of the construction industry in Pakistan. Additionally, the lack of regulatory reforms, inadequate government planning, cumbersome policies and weak client agencies are responsible for many of the problems faced by Pakistani contractors. All of these factors contribute to the poor business environment and serve to multiply the transaction costs of doing business.

Disproportionately cumbersome business processes such as land acquisition; obtaining clearances; external agencies processes; funding and payments; cost escalations; changes and modifications; and, final certifications serve as enormous obstacles for companies trying to enter the industry. Even established businesses face difficulties in carrying out these project cycle activities.

There is no restriction on entry into construction by unqualified players, which further results in low quality and productivity; serving as a disincentive to the qualified professionals. Compound this with the nearly non-existent practice of black-listing and eradicating poor performing contractors/consultants from the available pool causes the problem to appear to outsiders as insurmountable.

A further detriment to the growth of the construction industry in Pakistan is that the industry is dominated by a few construction and consulting firms who subcontract an appreciable portion of their work to smaller contractors. Generally, the size of these subcontracts does not appeal to foreign contractors and consultants, hence, competition is scarce. Additionally, specialty contractors with adequate skills, manpower, equipment and tools in the fields of electrical, mechanical, HVAC, etc. are largely limited.

Pakistan is a high risk country in which the owners' practice to accept low bids by local (albeit poor performing or unqualified) consultants and contractors discourages foreign consultants and contractors from competing in the market.

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Construction Industry Regulatory Environment

Construction, engineering and consulting organizations in Pakistan are subjected to three types of registration which are:

- Registration for the legal entity of the business upon its formation, followed by the requirement to submit annual/periodic reports;
- Registration with the official engineering body: Pakistan Engineering Council (PEC), requiring periodic renewal of registration and
- Registration with client agencies

In the case of registration as a legal entity, the submission of annual/periodic returns applies only to incorporated business entities such as limited liability, public or private companies. Other registered entities, such as registered partnerships and sole proprietorships do not have a requirement for annual returns. In registration with PEC, the periodic renewal plays a limited role, in so far as regulation is concerned, and registration requirements with the client agencies vary from client to client. Apart from the above, other associations which exist for the construction and consulting organizations mainly provide a forum and voice for their members, but cannot be considered as part of the regulatory framework of the construction and engineering consulting industry.

The PEC is however a formally recognized legal body which plays the role of a regulator for the industry, ensuring that minimum criteria are met for initial registration of an organization (construction contractors and consultants) and those criteria are maintained to enable yearly renewal of registration. A participating construction or consulting organization is required to keep its registration with PEC up to date. Although PEC is the official body for the industry, its role as a regulator is not dynamic or effective. PEC is not capable of monitoring projects and activities, their performance, adherence to professional and ethical standards or quality of construction materials used or application of technical skills on a project. There exists no form of continuous reporting or verification mechanism which should be in place for enabling such continuous monitoring.

Regulation of the construction and engineering consulting organizations is hence weak if not altogether absent, and in the absence of an effective regulatory body the owner plays the role of a regulator to a great extent through flawed and one sided contract documents. At times, in addition to client, several other government agencies and “committees” (such as the Chief Ministers’ inspection team) also indulge in acting as regulators. The client can, in the short to medium term and until such time as an effective overall regulatory environment develops, play its de facto role of a regulator in a more positive manner, provided that the relationship between client, “The Engineer” (consultant), and the contractor is honored as laid down in the FIDIC and PEC standard contract documents in letter and spirit. Adding the role of Construction Manager as an entity for professionally managing the project in its entirety is a dire need. Strengthening of the PEC or establishing a separate regulatory body is an option, which should be explored.

Suggested Steps to Improve the Regulatory Framework

1. PEC, being the primary regulatory body, should be more proactive in developing the industry.
2. PEC's capability needs to be enhanced on the following aspects: monitoring projects and activities, their performance, adherence to professional and ethical standards or quality of construction materials used or application of technical skills on a project. Continuous reporting or verification mechanisms need to be in place for enabling continuous monitoring.
3. The client can, in the short to medium term and until such time as an effective overall regulatory environment develops, play its de facto role of a regulator in a more positive manner, provided that the relationship between client, "The Engineer" (consultant), and the contractor is honoured as laid down in the FIDIC and PEC standard contract documents in letter and spirit.
4. Added role of construction manager as an entity for professionally managing the project in its entirety is a dire need.
5. Strengthening of the PEC or establishing a separate regulatory body is an option, which needs to be explored.
6. Current PPRA rules also support lowest bidder selection. This indicates that a lot of work is needed to streamline procurement rules and practices as well develop institutional capacities to implement procurement rules.
7. Granting "industry" status to the construction business has had no impact as without corresponding support from financial/lending facilities and without the implementation of reforms, no positive results are possible.
8. Audits are not concurrent, and delayed audits create opportunities for corruption. The role of auditors and the audit procedures need to be re-defined.
9. The only criterion emphasized in the regulations available is price competition and no provision is made to ensure the quality and safety of work being delivered. Hence there is a dire need to revise the regulations.
10. The role and mandate of institutions such as the PEC should be clarified and be made devoid of conflicting agendas as both a representative of the profession and an agent of the government.

Construction Industry Legal Environment

With multiplicity of contract forms, varied dispute resolution mechanisms, lack of willingness of parties involved to honor the awards, and no effective implementation mechanism in practice, disputes, in most cases, end up in courts of law and remain unresolved for long durations.

The Pakistani construction industry has tried to implement an ad-hoc arbitration process. However, the process has some major shortcomings that include:

- No provision of specific rules and requirement for parties to sign an agreement regarding the rules to be followed
- No provision for a neutral body to administer and supervise Arbitration
- No quality control of Arbitrator's qualifications and expertise and an obvious lack of close supervision/monitoring of arbitrator's progress
- No assistance available in managing Arbitrator's fees, and any administrative support.

One of the major reasons attributed to the poor effectiveness of the Ad-hoc Arbitration process is that at the time of signing the arbitration agreement, the owner often insists on having arbitrators from among its own serving or retired corporate officers or a panel with which it has some direct or indirect association. While this works in a large number of cases where the real intent of both sides is generally to reach an agreement, this also provides grounds for resorting to judicial remedies after the award is given.

Even when a settlement is reached through the arbitration process there is an increasing tendency to appeal on the grounds of "misconduct" on the part of arbitrators. Claimants particularly take the view that the arbitrator's decisions are not being approved by any responsible organization. This has added to the delays in the arbitration process which are increasingly resulting in time and cost overruns of projects.

Another grey area pertains to non-availability of clearly defined eligibility criteria and code of ethics with the appointing authority. Eligibility criteria for arbitrators are not fully transparent and do not follow a defined code of conduct.

Legal council needs to become involved to transform the ad-hoc arbitration system to one with credibility. At the least, the process must be modified to establish uniform requirements for qualification of arbitrators as well as instituting a method of establishing an unbiased panel.

Suggestions to Improve the Legal Framework

1. Construction Industry being the largest asset creator and second largest component of the economy having unique dynamics of business it is crucial that disputes be resolved speedily to minimize the business losses and capital blocked due to delayed and Ad-hoc process of dispute resolution.
2. The need has been widely felt to develop and set up in position the Institutional frameworks which can effectively tackle the hard-care problems of time and cost of the arbitration proceedings. The main objective for such an effort is to develop and place in position an Institutional Arbitration system, which would provide the following:
    a. appointment of arbitrators from the International and National or Regional panels,
    b. giving time commitment with a view to conduct arbitrations in an expeditious and cost effective way
    c. ability to act for conducting an audit for possible conflict,
    d. appointing an institutional appointee to execute institutional code of ethics,
    e. and providing a code of ethics for an Arbitrator focusing on impartiality, transparent communication, agreement on fees, and confidentiality.
3. A corrective measure needs to be taken to ensure the following:
    a. Laying down the eligibility criteria for nomination of arbitrators.
    b. Laying down the work ethics for nominated arbitrators, and setting up an implementation mechanism.
    c. Drawing up and adopting the arbitration and dispute resolution mechanism.

   d. Notifying and embodying the approved mechanism as a part of Standard Contract Conditions.
4. It is proposed to constitute a Construction Industry Arbitration Association (CIAA), which may operationalize these recommendations.
5. The CIAA will be entrusted with the task to articulate the following, in particular:
   a. Arbitration under Institutional rules formulated by Institution and revised periodically based on user feedback.
   b. Providing a panel of accredited Arbitrators based on selection criteria to maintain quality and standards and code of ethics/conduct.
   c. Management of Arbitrator's fees
   d. Monitoring and supervision of progress of case
   e. Arrangement of logistics, facilities and services for hearing.
   f. Controlling quality of Arbitrators,
   g. Maintaining a close supervision and monitoring of arbitrator's progress
   h. Providing administrative support for the whole process.

Ethical Behaviours in the Construction Industry

Corruption and transparency issues are the major challenges the government has to address in order to develop the capacity to improve the country's image. Implementation of FIDIC guidelines and contracts in letter and spirit is considered by industry participants to be essential for helping solve such problems.

Corrupt practices, which are a bane in the overall environment but over time have come to be accepted as 'necessary' and to be included if a project is to be won and then delivered with minimum hindrances. Offering bribes during the project lifecycle has become institutionalized. These practices cannot be called business processes but are an integral and unavoidable reality of the current business environment. These include unwritten procedures and fixed financial costs and charges for procedures such as; obtaining successful pre-qualification; having an audit objection cleared or expedited; obtaining timely approvals of work and release of payments; mobilizing the police to assist when needed; and for getting customs to give a favorable ruling of the duties and taxes on imports.

CONCLUSIONS

Generally, the contractors and the business environment in developing countries also tend to be under developed. Given the opportunity, they can overcome their inadequacies, but they cannot easily change the environment. The challenges being faced by the industry in developing countries include lack of long-term vision and planning for the industry; fluctuations in work load; defective contract documents; corrupt contracting procedures; and, unfair competition from state-owned contractors and consultants.

The structure of Construction Industry in Pakistan is highly skewed and characterized by small number of large construction companies, followed by very few medium level companies, and then followed by a very large number of small and petty contractors. It is ironic though, that the companies belonging to large segment in domestic context are also small when compared with those having International presence.

If the massive task of construction industry improvement has to be carried out, concerted efforts have to be made by the government under an institutionalized framework to change the skewed structure of construction industry, infuse better technology, further construction labor welfare and increase productivity and capacity of construction industry in Pakistan.

As the first step, the following initiatives need to be taken, for institutionalizing the framework that would improve the construction industry on strategic basis.

1. A Construction Industry Review Committee (CIRC) needs to be formed to comprehensively review the current state of the construction industry and to recommend improvement measures. The report to be submitted by the committee should outline improvement measures covering the whole spectrum of construction activities to uplift the quality and cost-effectiveness of the industry.

2. A statutory Construction Industry Development Board (CIDB) encompassing all key sectors should be formed to promote the culture of self-regulation in a market-driven environment. As an umbrella organization, the CIDB would be responsible for spearheading reforms and sustaining momentum to achieve continuous improvements across the construction industry.

The absence of a strong regulatory environment and authority is a problem that requires priority attention. Structurally weak legal and regulatory framework acts as a deterrent for attracting qualified consultants and contractors.

Finally, a dispute resolution process that has legitimate regulations as well as ethical and unbiased procedures will serve to encourage confidence in Pakistan's construction industry.

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SUBSIDIARITY RULE: UNJUST ENRICHMENT DOCTRINE IN CONSTRUCTION LAW

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Abstract:
It is now almost a Century since the concept of subsidiarity in the law of unjust enrichment was coined. Some jurisdictions have enacted it in their Civil Codes while others apply it to a variable degree even if not enacted in the Code or not officially sanctioned in their jurisprudence/case law. This article revisits the concept once again and challenges some of its theoretical foundations and its unqualified application in the law of unjust enrichment as a whole. Using South Africa and Brazil as main references, but extending the analysis to common-law jurisdictions, it explores the extent and limits of the applicability of such concept in claims arising from the built environment context by analysing the interaction of the subsidiarity rule or (otherwise) with the defence of change-of-circumstances/loss of enrichment where a legal system directly or indirectly sanctions or aspires sanctioning a general principle against unjust enrichment. It concludes that in three party cases subcontractors may be able to use enrichment law against owners to obtain an adequate remedy.

Key Words:
Contract and enrichment, subsidiarity, unjust enrichment.

1 Introduction

Placing special emphasis on claims arising from subcontracting scenarios in the built environment, this article re-examines the subsidiarity rule in the law of unjustified enrichment.[1] In essence, the subsidiarity rule precludes a free choice of actions between enrichment and contractual claims or other legally recognized claims. The rationale for such a rule is, inter alia, to prevent subverting the legal order, to safeguard the *paritas creditorum* rule in cases of intervening insolvency and to direct the plaintiff to the proper claim.[2] The paper argues that the direct and unqualified application of the

[1] The use of 'unjust' and 'unjustified' enrichment terminology: The concepts are not interchangeable. I have discussed their differences elsewhere in my works. But in this article they are used interchangeably whenever they refer to the subject as a whole, that is to say, whenever common-law would use 'restitution' or 'unjust enrichment' I refer to it uniformly as 'unjustified enrichment' for elegance sake in reading.
[2] Avoiding a concurrence between contractual and enrichment actions in such scenarios strengthens the legal system by preventing plaintiffs who concluded bad bargains from circumventing their *cum causa* claim and pursuing a more

subsidiarity rule (if a legal system officially sanctions it), or its indirect application (where the rule is not officially recognized but nevertheless applied), often leads to incongruent results.

The discussion approaches the issue from South African and Brazilian law[3] perspectives. Brief references are made to the Franco-Italian treatment of the problem for pioneering the concept of subsidiarity in its most reported forms. An overview of the common-law treatment of the rule is also provided. The American approach is slightly singled out at some point. The analysis looks at the issue regardless whether the respective legal system expressly provides for a subsidiarity rule or not.

The re-examination of the rule starts with a conceptual analysis of subsidiarity in general. It proceeds with a practical assessment of the rule in specific jurisdictions, namely South Africa, Brazil and common-law jurisdictions, collectively termed in the paper as the Anglo-American approach. The study culminates by revisiting the roots of this old concept and re-assesses the working or otherwise of the rule in the South African case *Palabora Mining Co v Coetzer*[4] as illustration. An underlying idea that permeates the discussion is the question whether the recognition of a general principle against unjustified enrichment (or the aspiration to that aim[5]) in a legal system impacts on the operation of this rule. If it does, the question is asked whether the rule has any effect on the change-of-position defence.

2 Conceptual Analysis

2.1 What is generally understood by subsidiarity?

At its simplest form, 'subsidiarity' in legal discourse means that two principles or doctrines are in a primary-secondary relationship. It may also mean that one principle or doctrine is constrained in the presence of the other;[6] or simply that there ought not to be a concurrence between two subject matters, because the existence of one renders the other unnecessary or undesirable.[7] However the precise connotation given to the notion

rewarding claim. Jacques du Plessis expresses this scenario with an analogy of a plaintiff "**A**" having someone's cake and eating it by enjoying both a contractual claim against "**B**" (their contractual partner) and an enrichment claim against the third party, "**C**" (see Jacques du Plessis, *The South African Law of Unjustified Enrichment*, (Juta Publishing 2012) 302).

[3] The Brazilian approach is assessed through the analysis of the provisions of Articles 875-886 of the New Brazilian Civil Code of 2004.

[4] (1993) 3 SA 306 (T).

[5] See Niall Witty and Daniel Visser, 'Unjustified Enrichment', in Reinhardt Zimmermann, Daniel Visser and Keith Reid (eds), *Mixed Legal Systems in Comparative Perspective: Obligations and Property in Scotland and South Africa* (2004) 366-98; CM Jooste 'Compensation for Improvements by Tenants in South African Law' in Eltjo Schrage (ed) *Unjust Enrichment and the Law of Contract* (Kluwer 2001) 257-274.

[6] Here the basic principle that is applied is that the specific rules concerning one doctrine take precedence over the general rules concerning the other: Expressed in the Latin version we say: *lex specialis derogat legi generali.* However, see Lionel Smith in David Johnston & Reinhardt Zimmermann (eds), *Unjustified Enrichment: Keys Issuesin Comparative Perspective,* (CUP 2002) 610, commenting on the limits of such an approach in understanding the subsidiarity of unjustified enrichment.

[7] See for example the position advanced in English law in *Pan Ocean Shipping Ltd v CreditCorp Ltd* [1994] 1 All ER 470 (HL) 473-474 where Lord Goff said: "there is a contractual regime which legislates for the recovery of overpaid hire. It follows that, as a general rule, the law of restitution [unjust enrichment] has no part to play in the matter; the existence of the agreed regime renders the imposition by the law of a remedy in restitution both unnecessary and inappropriate". For subsidiarity in Scots Law see among other, Martin Hogg *Obligations* 2ed

dependents on the legal system that uses it. It also depends on the specific circumstances in which the term is used, and how it came to be used in that legal system. Inasmuch as legal systems formulate their legal doctrines and principles differently, so will vary their understanding of subsidiarity. Therefore, it cannot be assumed without more that the concept of subsidiarity means the same thing in all legal systems or even that its use in a particular legal system is necessarily an unequivocal one.

Some commentators see in subsidiarity the expression of the ordering of the private law itself. They argue that it reflects the values and commitments of a liberal society. The drive of a liberal tradition, which accords primacy and maximization to individual autonomy to citizens, requires subsidiarity of one 'branch' of the private law such as unjustified enrichment to serve protective interests. It empowers private parties to facilitate their private decisions.[8] Others simply state that subsidiarity is a technique of limiting the applicability of the general enrichment remedy. As such its exact meaning is a matter of legal policy.[9] Within this second reasoning falls another approach, advocated by Visser.[10] He says that the whole debate around subsidiarity in a particular legal system is nothing more than a discussion about the role to ascribe to unjustified enrichment doctrine. But Visser cautions that subsidiarity may not be the best way to delineate the scope of enrichment liability as the predominant trend in the world indicates.

Sometimes legal literature describes subsidiarity in two other different modalities:[11] 'weak subsidiarity' and 'strong subsidiary'.[12] Weak subsidiarity directs the claimant to the correct claim. Strong subsidiarity usually denies the plaintiff any claim. Deeper analysis reveals however that weak subsidiarity is nothing more than the relationship between two different claims. Strong subsidiarity on the other hand, is a relationship between legal dispositions or a set of rules. On this analysis subsidiarity, at its weakest point, denotes the subordination of one claim where another claim in fact offers the plaintiff a basis of recovery. At its strongest point, subsidiarity denies the availability of a claim because another claim is in principle available, even though on the facts it does not avail the plaintiff.[13] In some jurisdictions, these two modalities are described as

(Avizandum Publishing 2006) 241-247; Niall Witty, '*Transco v Glasgow City Council*: Developing Enrichment Law after *Shilladay*' (2006) 10 *Edinburgh LR* 113.

[8] See Epstein 'The Ubiquity of the Benefit Principle' (1994) 67 *Southern Cal. L R* 1369; Ross Grantham and Charles Rickett 'On the Subsidiarity of Unjust Enrichment' (2001) *LQR* 273, 293.

[9] Eltjo Schrage, 'Unjustified Enrichment: Recent Dutch Developments from a Comparative and Historical Perspectives' (1999) *NILR* 57, 78.

[10] Daniel Visser, 'Unjustified Enrichment' in Jan Smits (ed) *Elgar Encyclopedia of Comparative Law* (Edward Elgar Publishing 2006) 767, 772-773.

[11] CM Jooste, 'Compensation for Improvements by Tenants in South African Law' in Eltjo Schrage (ed) *Unjust Enrichment and The Law of Contract* (Kluwer 2001) 269-271 who thinks that there are at least four usages of the concept. The other types of subsidiarity that he mentions are 'practical' or 'factual' subsidiarity. Factual or practical subsidiarity according to the author consists in legal representatives usually framing their pleadings in the first place in terms of contract or delict, for instance, and only as a last resort, a final alternative claim – as it were an afterthought – dragging in the enrichment idea.

[12] Lionel Smith in David Johnston and Reinhard Zimmermann (eds.), *Unjustified Enrichment: Key Issues in Comparative Perspective* (CUP 2003) 596-597.

[13] Ross Grantham and Charles Rickett 'On the Subsidiarity of Unjustified Enrichment' (2001) *LQR* 273.

'concrete' subsidiarity and 'abstract' subsidiarity.[14] For 'concrete subsidiarity' is understood the situation in which one action (ordinarily an enrichment action) is excluded only when, in the circumstances of the particular plaintiff, the other action will in fact enable him to make good his loss. 'Abstract subsidiarity' denotes the situation in which the enrichment is excluded whenever in principle the other action is available, or could have been available even if in the particular case the plaintiff will derive no benefit from it.[15]

More recently, Visser[16] added a modified analysis to these modalities of subsidiarity just described. He argues that subsidiarity can be analysed in a tripartite enquiry. Ultimately this inquiry gravitates around the problem of whether a particular jurisdiction has or has not recognised a general enrichment action. If it has recognised one, the question then becomes is how it views or classifies it, and how concurrence of actions is perceived. In Visser's own words the threefold enquiry is as follows:

[Subsidiarity] is a complex notion and it could encompass several different questions, namely (a) whether a claim based on a general principle against unjustified enrichment should be subsidiary to specific existing actions (in systems where a general action is introduced alongside existing remedies); (b) whether, in the case of concurrence of actions, an enrichment claim must be seen as a last resort, or one which may be chosen as an alternative to, say, a contractual claim (provided of course the elements of both types have been shown to be present); and lastly (c) to what extent, if the nature of the concurrence takes the form of the claimant having a claim in contract against his contractual partner and a claim in enrichment against a third party, the claimant should be allowed to chose whom to sue'.

The first question is only relevant in jurisdictions where a general enrichment action is already recognised. The second is relevant to jurisdictions that contemplate introducing a general enrichment action. For these last jurisdictions, Visser suggests that the safest route is to recognise a general enrichment action which is subsidiary to the currently existing actions[17] because the unitary approach may not necessarily work.[18] The second question also underlines the debate what role a particular legal systems wants to give to the doctrine of unjustified enrichment. The third question is mostly relevant to the views on concurrence of actions between the different branches of private law or where actions are allowed to be pleaded in the alternative, especially where third parties are in issue. Hence, Visser concludes that

'if in a particular system the rule is that, once a claimant has exhausted the possibility of getting satisfaction from his contractual partner, he may institute an enrichment action

[14] This is the Italian position. Netherlands also had something similar. See Eltjo Schrage 'Unjustified Enrichment: Recent Dutch developments from a Comparative and Historical Perspective' (1999) *Netherlands International Law Review* 57-87.
[15] Barry Nicholas, 'Unjust Enrichment and Subsidiarity' in *Studi in Memoria di Gino Gorla, Vol III* (1994); Jack Beatson and Eltjo Schrage (eds) *Cases, Materials and Texts in the Law of Unjust Enrichment* (Hart Publishing 2003) 428.
[16] Daniel Visser, 'Unjustified Enrichment' in Jan Smits (ed) *Elgar Encyclopedia of Comparative Law* (Edward Elgar Publishing 2006) 767, 771-773.
[17] This view reflects the approach followed by the Quebec Civil Code and to some extent the structure reflected in the new Brazilian Civil Code to which I will refer later in this paper.
[18] This is mostly true of the German law treatment of its provisions in articles §§ 812- 822 of the BGB.

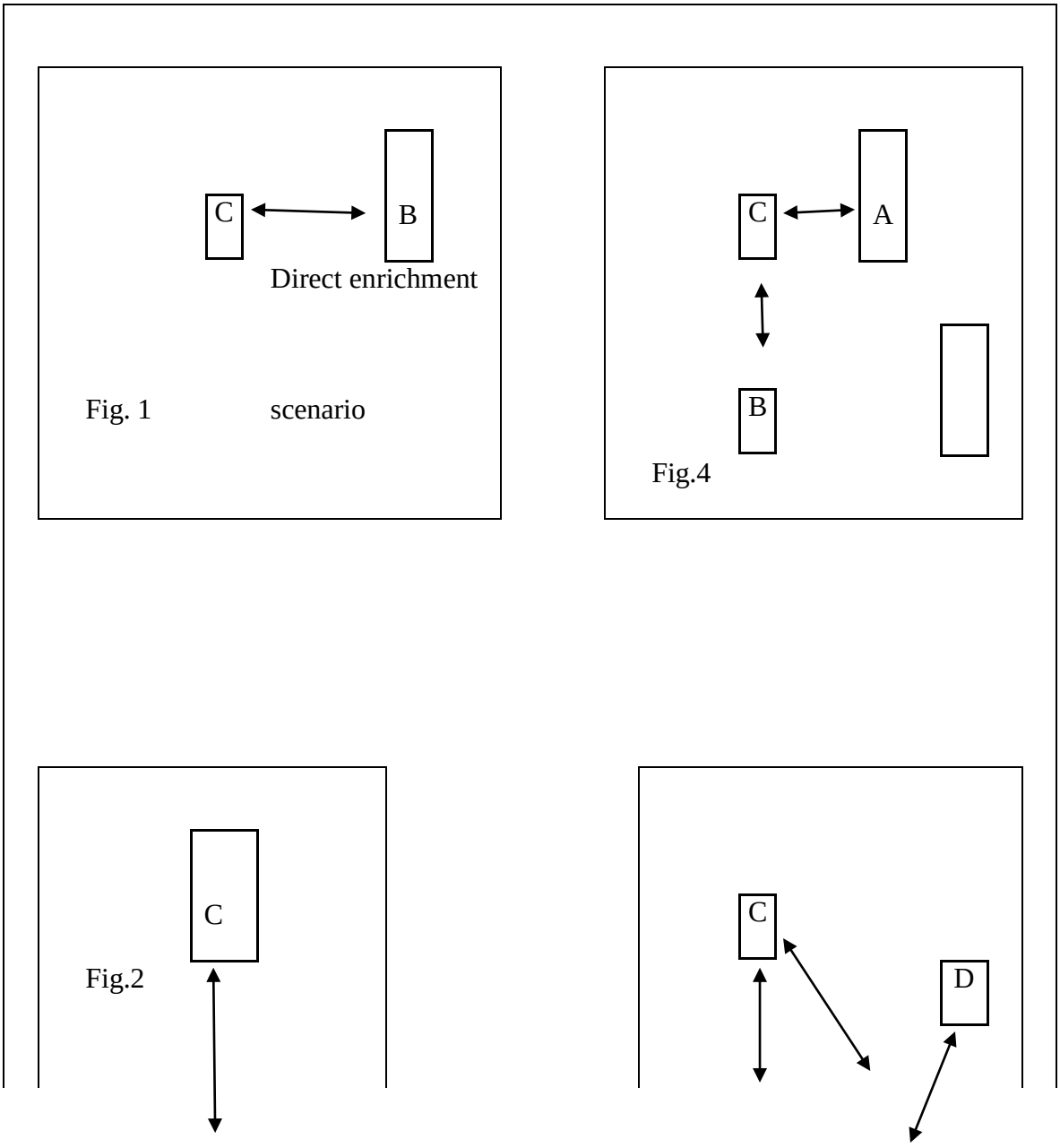
against a third party on the basis of unjustified enrichment, one has a situation of true subsidiarity. If however, a jurisdiction allows only one of the actions, that action is not subsidiary to the other possible action, but alternative. This is the province of multiparty enrichment'.

For the aforesaid it is obvious that the precise understanding of the concept 'subsidiarity' can only be captured if it is analysed in the context in which it is used.

Before I consider the concept in the specific jurisdictions mentioned above, some illustrative diagrams depicting different enrichment scenarios are in order.

2.2 Diagrams and Descriptions

Diagrams representing different enrichment scenarios



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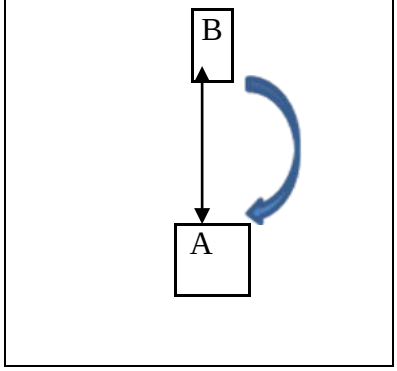

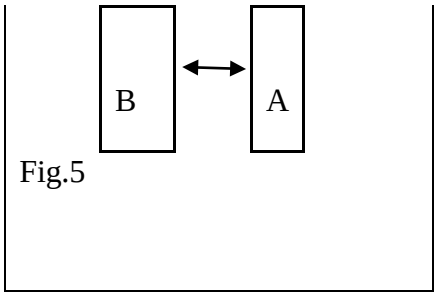

Fig.5

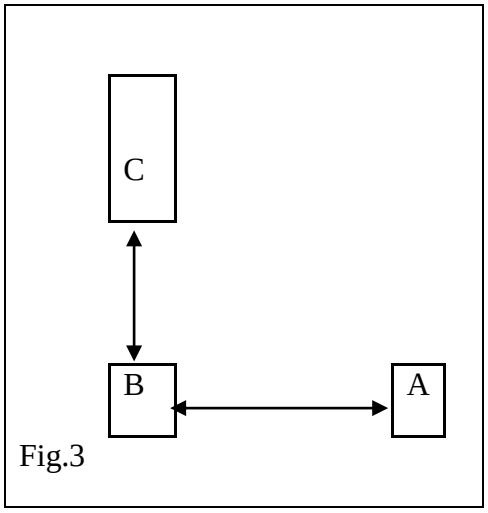

Fig.3

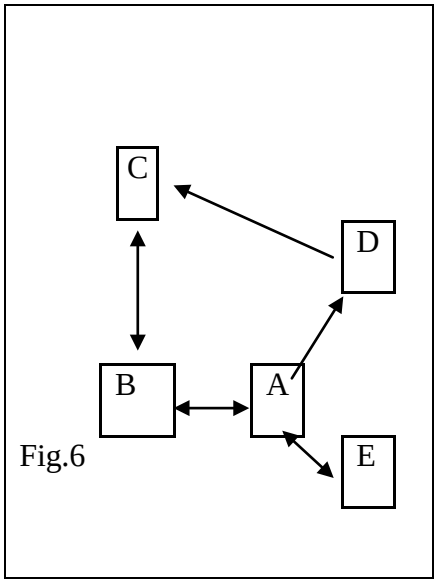

Fig.6

DESCRIPTIVE EXPLANATION OF DIAGRAMS

Fig. 1

Direct enrichment scenario.

Fig.2

A does work for B on C's premises.

A is fully paid by B. C evicts B

with no compensation

Fig.3

C contracts with B for a building Project. B subcontracts it to A. In turn A duly performs the building work on B's behalf on A's land. B goes insolvent. A sues B for recover of benefits conferred on C at C's expense.

Fig.4

C engages B to Build for him for $200.000. B does substantive work, but he does not complete it. C engages A to finish the work and pays him $50.000 A is enriched at B's expense for $150 000

Fig. 5

C engages B for building services. B subcontracts the work to A. A sends his own subcontractor D to do the work. D does the work and incurs. expenses. C is unaware of this chain. B becomes insolvent and D is not paid.

Fig.6

C engages B for a work. B subcontracts the work to A. A in turn uses two specialist services provided by D and E. D does the work on C premises on C's premises using own resources not agreed with A but E does so in agreement with A. B who has engaged A goes insolvent. A is clearly enriched at expense of D and E through services subcontracted by A.

2.3. The Operation of the subsidiarity rule in specific jurisdictions.

2.3.1. The South African approach to subsidiarity rule.

The notion of subsidiarity in the South African law of unjustified enrichment is virtually unknown.[19] As the law now stands, the basic approach is to allow a plaintiff the freedom of choice between alternative remedies. This in essence amounts to concurrence of contractual and enrichment remedies, or probably with any other area of the law. However, such freedom of choice is not so wide open in practice. Each factual scenario is to be evaluated on its own merits. A general distinction occurs between situations involving only two parties and those involving more than two parties. For example, in *ABSA Bank (Pty) Ltd v De Klerk*[20] the judge held that where 'the plaintiff has requested judgment on the alternative claim, the choice of relief lies with the plaintiff. The law does not compel the court to exclude the alternative claim merely because the plaintiff made the *conditio indebiti* its main claim.

A closer look at other South African decisions reveals generally two scenarios:

Firstly, where two parties are involved the choice of remedies lies with the plaintiff. But that choice may be curtailed for what I call 'an internal subsidiarity'.[21] The *condictiones* generally preclude the claimant to institute freely the *condictio* of his choice because the elements of each *condictio* are different. Also different requirements apply to each *condictio*. If a claimant is entitled to a relief under *condictio indebiti* he may not claim his relief under the *condictio sine causa*. Despite inconsistency in some cases, this is the prevailing attitude of the courts. In *Govender v Standard Bank,*[22] the Court held that a formalistic approach should be avoided where possible. 'In some cases it is necessary to classify the cause of action; in others where no issue turns upon classification of the cause of action, a plaintiff need not place a label upon this case. If he can show a prima facie case for a relief, it is not necessary for him to commit himself in advance in his pleadings to one form of action to the exclusion of another'. But later the judge notes that 'the *condictio sine causa*, in the special form (*specialis* as opposed to *generalis*) may be brought where the *condictio indebiti* is inappropriate to the case. Indeed, it cannot be brought where the *condictio indebiti* applies to the case'.

Secondly, where three parties are involved the situation is wide open. In some instances free choice and concurrence of actions will readily be allowed. In others such choice will be curtailed for the sake of internal consistency of the legal system. Such an

[19] The editor of chapter seven in Jack Beatson and Eltjo Schrage (eds.) *Cases, Materials and Texts on Unjustified Enrichment* (CUP 2003) 424 is puzzled why the issue is not discussed at all in South African law. He notes that that might be the case because the question of the subsidiarity of the enrichment-claim plays a more important role in jurisdictions which acknowledge a general claim than those that stick to the older specific remedies. And South Africa is still one of the few jurisdictions sticking to the piecemeal older Roman law remedies. However, the learned editors may have overlooked a recent case in the Cape Provincial Division (Cape Town) that has done remarkable survey on the extended *actio negotiorum gestio* that highlights cases in which an analogous approach to the *actio de in rem verso* is present – *ABSA Bank Ltd t/a Bankfin v Stander t/a Caw Paneelkloppers* (1998) 1 SA 939. But see Jacques Du Plessis, *The South African Law of Unjustified Enrichment* (Juta 2012) 298-306.

[20] (1999) 1 SA 861 (W).

[21] By implication, the other not mentioned is considered 'external subsidiarity'. By 'internal subsidiarity' I mean the exclusion of the other action within the same branch of law (in *casu* within unjustified enrichment) and 'external subsidiarity' in relation to the other branches of law (e.g, contract, delict (tort), property, etc).

[22] 1984 (4) 392 (CPD) at 396D-E.

approach can be inferred from various dicta in the cases. For example, the Supreme Court of Appeals in *Bowman*[23] case inter alia, held that the principles underlying the *condictio* (*condictio indebiti* in casu), are not immutable. In principle, a party is entitled to rely on the application of the *condictio indebiti* by analogy'.[24] The rules of the *condictio* are also not identical for all situations and there is scope for deviation, for instance where deceased or insolvent estates and the like are concerned.[25]

Thus, where third parties are involved, or where A tries to recover from C that which B has paid to C, there is a possible subsidiarity rule (or otherwise) in South African law. Ulpian in the *Justinian Digest* 12.6.5 mentions that 'there is nothing new about one person recovering with the *condictio indebiti* what another has paid'. It is my view that the same dictum would apply where other *condictiones* are involved if the facts so demand and justify it. Similarly, there is a rule in South African law stating that 'an unpaid or underpaid creditor of a deceased estate is entitled to recover from overpaid heirs and legatees, even though the payments have been made by the executor'.[26] He may do so under the *condictio indebiti* or *condictio sine causa*. This rule also seems to support the availability of an enrichment claim where third parties are in issue. The courts show some flexibility in practice. They extend the same rule of the unpaid creditor of a deceased estate to the case of a creditor of a dissolved company. Such extension enables a creditor to claim an overpayment from a shareholder who received more than he was entitled to.[27] This flexibility therefore points to a willingness to consider some sort of weakened subsidiarity in South Africa law.

This willingness is clearer in the 'subcontractor' cases. These cases however, are equally tricky because the decisions are not always easily reconcilable on strictly legal analysis. They invite more policy considerations. Visser and Miller[28] suggest that the anomalous outcome these cases expose could be addressed on a two-tier policy consideration. The first-tier is analogous to the process followed in delict (the law of torts), specially in pure economic loss situations.[29] The second-tier (which, with due respect, is unclear and very discretionary) dependent upon a positive outcome of the first-tier, is to 'determine whether, in the particular circumstances of the case at hand, a claim based on unjustified enrichment should be allowed'.[30] If the decision in this

[23] *Bowman, De Wet and Du Plessis NNO and Others v Fidelity Bank Ltd* 1997 (2) SA 35 (A) 43B-C.
[24] *Komissaris van Binnelandse Inkomte en 'n Ander v Villiers en Ander* 1994 (3) SA 203 (A) 333G-H; *Bowman v Fidelity Bank Ltd* (1997 (2) SA 35 (A) 40B-C.
[25] *Bowman, De Wet and Du Plessis NNO and Others v Fidelity Bank Ltd* 1997 (2) SA 35 (A) 43B-C.
[26] Idem at 40C.
[27] *Komissaris van Binnelandse Inkomte en 'n Ander v Villiers en Ander* 1994 (3) SA 203 (A) 330H-J. Here the Appellate Division effectively overruled an earlier decision in the Transvaal Provincial Division in *Rapp and Maister Holdings Ltd v Ruflex Holdings (Pty) Ltd* 1972 (3) SA 835 (T) that had held otherwise. In *Bowman, De Wet v Fidelity Bank* 1997 (2) SA 35, 43 D-E Harms JA held that 'depending on the circumstances of the case, A may claim from B that which C has overpaid, especially if C was acting in a representative or fiduciary capacity'. Hence, where liquidators acting in a joint capacity are impoverished to the full extent of an overpayment made to other creditors, where there has been an scheme of arrangement providing to pay such creditors, the liquidators in their capacity as joint receivers, become entitled to recover what was lost to the creditors, and the recovery would include any other party to the scheme whose money had been used to pay a creditor (*Bowman* 43E-F).
[28] Daniel Visser and Saul Miller 'Between Principle and Policy: Indirect Enrichment in Subcontractor and garage Cases' (2000) 117 *South African Law Journal* 594, 603-617.
[29] For an extensive exposition of the pure economic loss situations in the interaction between contract and delict, see Martin Hogg *Obligations* 2ed (Avizandum Publishers 2006) 108-194.
[30] Daniel Visser and Saul Miller 'Between Principle and Policy: Indirect Enrichment in Subcontractor and Garage Cases' (2000) 117 *South African Law Journal* 594, 606.

policy consideration is negative, the matter ends there. If however, it is positive, the courts should proceed, allegedly on *ad hoc* basis, to decide the actionability of the case based on the requirement of 'unjustifiedness' or that of 'at the expense of'[31].

A positive outcome on the first-tier, leaves further hurdles in place. These include the following questions: (i) how to reconcile the decisions with the possibility that allowing the subcontractor a claim may deprive the owner a possible defence against the main contractor? (ii) How to avoid the possibility that the subcontractor's claim could disturb the '*paritas creditorum*' rule against the owner in cases of insolvency? (iii) How to avoid the risk of placing the owner in the position of facing two potential successful claims by both the subcontractor and the main contractor? If the subcontractor is allowed to institute his claim, a later claim by the main contractor, as rightly Visser and Muller recognise,[32] could be met with the change-of-position defence for having given up the enrichment to the subcontractor.

Obviously, these difficulties strengthen the need for a general enrichment action that will allow the legal system to fully explore the contours of its defence of change of position.[33] If such a defence is conceptualised in two main versions, that is to say, in the reliance versions and the disaster version, an exit door to the difficulties posed by such cases could be conceptualised.

However, the clearest cases of subsidiarity in South African law arise in the so called 'extended *actio negotiorum gestio*[34] which is effectively an action *de in rem verso.*[35] Usually such action takes place in three party situations (see *Diagrams* Fig. 2 to 6 at 2.2 above) where A at the instance of B performs services for C without agency or something similar linking A and C. Sometimes A is unable to recover from B, where A was impoverished and C enriched as a result of A rendering services to C. In such cases A is sometimes allowed to claim directly from C on the basis of the latter's unjustified enrichment at the expense of B.[36] This situation involves an 'indirect' or 'third party'

[31] Idem 605.
[32] Idem 607.
[33] The defence of change of position in South African law is known as 'loss of enrichment'.
[34] The same action has historically been referred to with various names. It is sometimes called as *actio negotiorum gestorum contrar*ia, or according to some glossators as '*utilis actio negotiorum gestorum*'. Some Pandectists called it '*actio de in rem verso utilis*'. See generally Dion Van Zyl, *Die Saakwaarnemingsaksie as Verrykingsakie in die Suid-Afrikaanse Reg: 'n Regshistoriese en Regsergelykende Ondersoek* (1970) 87-88. For a similar study in Portuguese law, Diogo De Campos, *A Subsidiariedade da Obrigação de restituir o Enriquecimento* (Almendina Publishers 2003)) 55ff, also arrived at the same conclusions in his survey and uses in Pre-BGB Codifications such as the Prussian ALR 1794; the Austrian ABGB 1811, etc, which are however in contrast with the Codification Projects of Hessen 1842-1853 (art. 640ff), The Bavaria Project Code 1860 (arts. 902 and 750) and the Saxe Civil Code 1863 (arts. 1357, 791, 1519 and 1547) all of which either ignore the *actio de in rem verso* or the action is restricted to the cases of *negotiorum gestio* or severely curtailed.
[35] *Actio de in rem verso* is the concept mostly used in French law and generally refers to an enrichment claim not provided for under the French Civil Code, but it was sanctioned by the Cours de Cassation in *Boudier'*s case in 1892.
[36] See for example what Cloete J said in *Hubby's Investments (Pty) Ltd v Lifetime Properties (Pty) Ltd* 1998 (1) SA 295 (W) referring to the *Buzzard Electrical* case (1996 (4) SA 19 (A) 25H-26A): '[T]he Appellate Division characterized two of the situations which frequently arise in matters such as the present as 'type 1' and 'type 2' claims. The two types are as follows: The first arises when A effects improvements to the property of an owner, not pursuant to a contract with him but pursuant to a contract with B, and A then sues the owner for enrichment. The second type arises when the owner contracts with B for improvements to his property but B, instead of doing the work himself, subcontracts it to A and A sues the owner once he has completed the work' (at 297H-I). However the Appellate Division had already said in *Brooklyn* case [(1970) 3 SA 264 (A)] that 'Dit is byna vanselfsprekend dat verryking van die eienaar deur die besteding van nuttige of noodsaaklike uitgawes aan die saak, ten koste is van die persoon wat die uitgawes aangegaan het, en na my oordeel is dit, met betrekking altans tot die bestaan, al dan nie, van

enrichment. Huber in *Prelaetiones Juris Civilis*[37] based the action in these circumstances on equity and regarded it as subsidiary to a direct action based on contract. He says that '*ex aequitate contra alium dandam in subsidium actionem, quia quod de me ad te pervenit, hoc a te mihi rendid, bonum et aequum est*'.[38] The recent case *ABSA Bank Ltd t/a Bankfin v Stander t/a Caw Paneelkloppers*[39] echoes Huber's assertion above. The same approach also appears in *Knoll v SA Flooring Industries Ltd*[40] where De Villiers J criticising *Williams' Estate*[41] case, inter alia, said the following:

'[it] seems to me if a person, thinking that he was authorised to do so, that he had been engaged by the owner, *bona fide* does certain work to his house by which he has benefited – been enriched – in a certain amount it would be unjust for the owner to be enriched at the expense of the builder, and the latter could in equity claim the amount by which the owner has been enriched. That seems to me a perfectly good cause of action and, although one may bring it under the principles of *negotiorum gestor* (sic), it does not seem to me it is essential, for success in an action, to bring it in that principle. The equitable doctrine of unjust enrichment is wide enough to cover the facts in William's case to my mind'.

At this moment, however, there appear to be two conflicting decisions in South African law on the extended *actio negotiorum gestor: Gouws v Jester Pools (Pty) Ltd*[42] and *ABSA Bank v Stander.*[43] Both these cases were decided on appeal by two judges in their respective provincial divisions and are not the final word on the issues raised for all other provincial divisions. However, it is theoretically possible that *Gouws* case has been overruled by implication by the Supreme Court of Appeals in *Brooklyn House*[44] or at least by the rejection of the artificial distinction between an 'enrichment action' and 'enrichment lien' in *Buzzard*[45] *case*. If that is not the case, then the situation remains unsettled.

Academics on the other hand disagree on indirect enrichment claims in South African law. One group is keener to maintaining consistency and strict logic in the legal system.

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so 'n retensiereg, nie ter sake nie dat die uitgawes aangegaan is ingevolge 'n geldige kontrak met 'n derde teen vergoeding'. Therefore, 'once the Appellate Division has recognised a right of retention in the first type of cases (*Brooklyn, JOT Motors*); and once the Appellate Division has declared that the distinction between right of retention and action is a distinction without a difference (*Buzzard* case), it must follow, as a matter of logic, that an action is also maintainable in the first type of case' (at 299C-D).

37 Ulrich Uber, *Praelectionum Juris Civilis* Tomi III (Lipsiae 1735) 15.3 n2.

38 This text is translated as follows:"A subsidiary action must be given against the other because it is good and fair that that which you have received from me should be returned by you to me".

39 (1998) 1 SA 939 (CPD). In this case, Van Zyl J, said the following: '[I]n cases of indirect enrichment, recourse is had to the action arising from the *bona fide* management of another's affairs under the mistaken belief that they are the *gestor's* own. The varying nomenclature used to describe this action is irrelevant. What is relevant, however, is that it appears to operate as a subsidiary action, when a direct action against another party should not be available or effective. Equity then dictates that the *gestor* should not be unjustifiably impoverished and the *dominus* unjustifiably enriched as a result of the *gestor's* performance which has been the *dominus'* (at 946 C-D).

40 1951 (1) SA 404 (T) 408A-C.

41 *Williams' Estate v Molenschoot and Schep (Pty) Ltd* 1939 CPD 360.

42 1968 (3) SA 563 (T).

43 1998 (1) (SA) 939 (CPD).

44 *Brooklyn House Furniture (Pty) Ltd v Knoetze and Sons* 1970 (3) SA 264 (A).

45 *Buzzard Electrical (Pty) Ltd v 158 Jan Smuts Ave. Investment (Pty) Ltd en 'n Ander* (1996 (4) SA 19 (A). The *Buzzard's* distinction was again referred to by the Supreme Court of Appeals in *Singh v Santam Insurance Ltd* 1997 (1) SA 291 (A).

The other group is more pragmatic and policy oriented. Among the first are De Vos[46] and Sonnekus.[47] This group basically contends that allowing indirect enrichment opens the door to subverting the legal order. Sonnekus' contention is that whenever there is any intervening contractual obligation to render performance, the relevant impoverishment and enrichment cannot be regarded as *sine causa* but it is always *cum causa*.[48] De Vos in turn objected to allowing such claims because they would, inter alia, conflict with the principle of *paritas creditorum* in case of intervening insolvency. If, for example, B (the enriched) should become insolvent and A (the claimant) would then have a choice between contractually suing the insolvent estate of B, on the one hand, or suing C (a third party) on the basis of unjustified enrichment, on the other. He contends that in the first scenario the claimant would only have a concurrent claim against the insolvent estate, while in the second scenario he would be able to claim the full amount owing on an enrichment basis.[49] This situation effectively subverts the legal order.[50] Among the second group are Honoré,[51] Van Zyl[52] (later a judge), Scholtens,[53] Visser[54] and Du Plessis.[55] Although for different reasons, either based on the presence of such an action in South African law by surveying the common law authorities and the South African case law (Hororé), or by a rigorous analysis of the requirement 'at the expense of' among others (Scholtens), or for equitable reasons, judicial expediency and judicial policy (Visser and Du Plesiss), all authors agree that unjustified enrichment has an 'equitable connotation'. As such it must be able to grant a relief where there is manifest injustice and no policy considerations militate against granting such a relief. Where, for example, it will be unjust and inequitable to deny A an action against C when it is clear that A has been impoverished and C enriched as a result of A's services or activity on C's property, and A would not have recourse against B, because B, for instance, has disappeared from the scene rendering any potential action against him or by him academic, justice and fairness certainly demand that there must be some recourse. In such a case to adhere to a rigid approach is inequitable. If a contractual action should be useless or academic, the plaintiff should not be allowed to suffer an irrecoverable loss and the defendant to derive an unassailable benefit for which he does not pay. The fact that, on the face of it, the claimant might not have (strictly) complied with the causal requirement should not, in the circumstances of these kinds of cases, deprive the plaintiff of an enrichment action.

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[46] Wouter De Vos 'Retensieregte Weens Verryking' (1970) 33 *THRHR* at 357-88.

[47] Jean C Sonnekus, 'Retensieregte – Nuwe Rigting of Misverstand *par Excellence*?' (1991) *TSAR* 480 and also (1996) *TSAR* 583, 590-591.

[48] Jean C Sonekus, *Unjustified Enrichment in South African Law* (Nexis Nexus 2008) 63.

[49] Compare this holding with the Italian 'concrete' and 'abstract' meaning of subsidiarity above.

[50] cf. Wouter De Vos, 'Retensieregte Weens Verryking' (1970) 33 *THRHR* 357-388 and Jean C Sonnekus, 'Retensieregte – Nuwe Rigting of Misverstand *par excellence*?' (1991) *TSAR* 480.

[51] Honoré 'Third Party Enrichment' (1960) *Acta Juridica* 236-253.

[52] Dion Van Zyl, *Negotiorum Gestio in South African Law* (Butterworts 1985) and *Die Saakwaarnemingsaksie as Verrykingsaksie in die Suid-Afrikaanse Reg: 'n Regshistoriese en Regsvergelykende Ondersoek* (1970) (a Doctoral Thesis).

[53] Etienne Scholtens, 'Enrichment at Whose Expense' (1968) 85 *South African Law Journal* 371-379 and (1968) *Annual Survey of South African Law* 150-152.

[54] Daniel Visser, 'The Role of Judicial Policy in Setting the Limits of a General Enrichment Action' in Khan (ed.) *The Quest for Justice: Essays in Honour of Michael McGregor Corbett, Chief Justice of the Supreme Court of South Africa* (Juta 1995) 342, 358-361; Daniel Visser, 'Searches for Silver Bullets: Enrichment in Three Party Situations' in David Johnston & Reihnard Zimmermann (eds.) *Unjustified Enrichment: Key Issues in Comparative Perspective* (CUP 2002) 526, 530-538.

[55] Jacques Du Plessis, *The South African Law of Unjustified Enrichment* (Juta 2012) 298-306.

In sum, although not expressly discussed under a specific heading, the issue of subsidiarity has been ventilated in South African law either through third party and indirect enrichment cases or through the discussion of the appropriateness or priority of one *condictio* over the other (or others), and the result is that policy considerations and other factors may dictate some departures from strict logic and formalism. In other words, concurrence of actions in contract and unjustified enrichment is recognised if policy considerations are not against granting the third party an action.

2.3.2. *The Subsidiarity rule in Brazilian law.*

Brazil, similarly to the Quebec *Code Civil*[56] and Portuguese *Codigo Civil*,[57] has now enacted a general enrichment action in the Civil Code of 2004 (articles 884-886). However the action for the *repetição do indevido* (reception of a thing not due (articles 878-883))[58] also continues to exist separately from the general enrichment action. But both actions fall under the heading 'unilateral Acts' (*Dos atos unilaterais*). Thus the nature of enrichment liability in Brazilian law as codified entails a general enrichment action alongside other claims of unjustified enrichment that apply only to particular fact patterns. Because this legal system provides more than one type of claims for unjustified enrichment, the way the provisions are structured reveals that a plaintiff is not allowed a free choice among these different types of claims, even where the facts of the case satisfy more than one claim. Under its dual structure, one type of claims is considered to be of a general nature while the other is of specific character. The law structured in this way, will more likely hold that the general claim will not be appropriate where the facts fit the claim for *repetição do indevido* even though the latter may not succeed.[59] The subsidiary character of enrichment claims is defended inter alia on the basis that it is the only way to prevent the judge, under the apparent cover of equity,[60] to fall prey to

[56] Québec Civil Code, articles 1493-1496.

[57] *Portuguese Civil Code*, articles 473-480. Article 474 provides 'Não há lugar à restituição por enriquecimento quando a lei facultar ao empobrecido outro meio de ser indemnizado ou restituído, negar o direito à restituição, ou atribuir outros efeitos ao enriquecimento' [There shall be no restitution by enrichment *sine causa* if the law provides to the impoverished another means for indenmization or restitution, or that negates him the right to restitution or that gives to the enrichment other results]. Note however that this subsidiarity in Portuguese law was vehemently opposed in the *Travaux Préparatoire* leading to the 1966 Civil Code, especially by Vaz Serra (in articles 721 of the 'Anteprojecto de Direito das Obrigações' [Project Draft on the Law of Obligations]. However, Article 474 of the Project that emanated from the Second Ministerial Revision, leaned towards the Italian Civil Code article 2042, to keep Portuguese law in line with Belgium law and French jurisprudence (See Antunes Varela *Das Obrigações em Geral* 10th Ed (Almendina 2000) 500). Up to 1970, Vaz Serra maintained his position that the subsidiarity of the unjustified enrichment introduced in the Code was not a secure principle (Annotation to judgment of S.T.J. (Supremo Tribunal de Justiça) of 6 January 1970 in *RLJ (Revista de Legislação e de Jurisprudência);* No. 104, 24).

[58] This is the French action of *réception de l'indu.*

[59] See for example a Canadian case decided under the Civil Code of the Lower Canada with similar structural provisions – *Willmour Discount Corp. v Vaudreil (City)* (1994) 2 SCR 210, 227.

[60] The exaltation of equity can for example lead a court to find a 'constructive trust' such as in the Canadian case *Pettkus v Becker* (1980) 117 DLR (3d) 257, where there would probably be none in many legal systems. There Dickson J for the majority in the Supreme Court held, inter alia, that 'the great advantage of ancient principles of equity is their flexibility: the judiciary is thus able to shape these malleable principles so as to accommodate the changing needs and mores of society, in order to achieve justice. The constructive trust has proven to be a useful tool in the judicial armoury…'. Then the judge referring to his previous case in *Rathwell v Rathwell* (1978) 83 DLR (3d) 289 applies the constructive trust in the unjustified enrichment case in the context of matrimonial property controversies (at p 273 ff). But Martland J, for the minority immediately warns: 'In my opinion, the adoption of this concept involves an extension of the law as so far determined by this Court. Such extension is, in my view, undesirable. It would clothe the judge with a very wide power to apply what has been described as 'palm tree justice' without the benefit of any guide-lines. But what test is a judge to determine what constitutes unjustified enrichment? The only test would be his individual perception of what he considered to be unjustified' (at 262).

arbitrariness. He would then transform the bench into an 'office of public assistance', instead of a court of law.[61] Thus, failing to make enrichment claims subsidiary, equates to allowing uncertainty to govern the law.

However various borderline problems that other legal systems tend to resolve under enrichment liability, such as why a transaction was declared invalid or the fundamental agreement that served as the base of the transfer of property has prescribed, etc, Brazil deals with them through the simple mechanism of nullity, rescission or through the contract itself.[62] Therefore this system accords maximum primacy to a contractual regime. It endeavours resolving most of the issues within the contractual realm as long as they have any contractual link real or apparent. This choice seems very narrow. However this choice seems to reduce litigation, promote finality and certainty, and encourages self-reliance. For Brazilians, a less restrictive approach to enrichment liability such as that of Germany and more recently the English approach are mostly seen as unsettling people's power to control their affairs through contract and gifts, and/or as opening the floodgates of litigation. That is so because every disposition of wealth is vulnerable to be subjected to a review with inquiries into the effects of legal transactions not only on the immediate parties but also on third persons and persons further removed. Whether these and other fears regarding the law of unjustified enrichment and the ambits of its defences are well founded, and to what extent justice is fully served under the narrow paths are issue that may need further analysis. For the time being, however, that is all that I have to say.

One problem that arises under current Brazilian enrichment law, is whether the now sanctioned 'general enrichment claim' which states in article 886 that the claim is subsidiary, also applies to the *condictio*-version of the claim. That is to say to claims arising under Articles 887-883 of the Brazilian Civil Code. That is so because those claims are not labelled as enrichment "*sem causa justa*" [senza justa causa]. A quick glance to article 886 would suggest so, because it says 'enrichment claim shall not lie if the law offers another remedy for the aggrieved party to redress his loss'.

2.3.3. *The Anglo-American approach to subsidiarity rule.*

The current common-law of unjust enrichment is very diverse. It varies greatly from jurisdiction to jurisdiction. In many instances there is little agreement. In some jurisdictions, especially in the USA, it is still called the law of quasi-contracts[63] with all

[61] Antunes Varela, *Das Obrigações em Geral* Vol. I (Almendina 2000) 507.
[62] Idem. 505.
[63] Louisiana Law, for example, following its Civil-law tradition, abandoned as recently as 1995 the '*Quantum Meruit*' as the basis for recovery in unjustified enrichment. It codified its main law of unjustified enrichment in article 2298. An history and explanation of Louisiana law is provided in Jeffrey Oake, Comment, 'Article 2298, The Codification of the Principle Forbidding Unjustified Enrichment, and the Elimination of Quantum Meruit as a Basis for Recovery in Louisiana' (1996) 56 *Louisiana LR* 873. A handful of other States call it the 'law of enrichment by impoverishment' whose elements are (i) an enrichment, (ii) an impoverishment, (iii) a connection between the enrichment and the impoverishment, (iv) absence of justification for the enrichment and impoverishment and (v) an absence of a remedy provided by law (for this view see generally Mark Gergen 'What Renders Enrichment Unjust?' (2001) 79 *Texas LR* 1927); others such as Lionel Smith in the Canadian context call it 'autonomous unjustified enrichment' (see Lionel Smith 'Restitution: The Heart of Corrective Justice' (2001) 79 *Texas LR* 2115, 2116); Andrew Kull on the other hand, leans more towards a civilian approach as he holds that the enrichment determination

the intricacies of that concept. Equity still prevails in the field, despite the enactment of the Restatement First of Restitution nearly 80 years ago and more recently the Restatement Third of Restitution and Unjust Enrichment[64]. Though they are becoming rare, some cases still hold that the three elements of unjustified enrichment are: '(i) a benefit conferred upon the defendant by the plaintiff; (ii) an appreciation or knowledge by the defendant of the benefit; and (iii) the acceptance or retention by the defendant of the benefit under the circumstances as to make it inequitable for the defendant to retain the benefit without the payment of its value'.[65] These expressions still mimic the elements of quasi-contract or implied contract theory. In Canada (excluding Québec), unjustified enrichment is based on three pillars, the third of which is enrichment without '*juristic reason'.* The remedy of constructive trust first sanctioned in *Pettkus v Becker*[66] is being extended beyond the realm of marriage. In such a context it is difficult to extract a unified concept of subsidiarity, if any, that covers to all common-law jurisdictions. However, it is encouraging (unlike in the South African law)[67] that the existing literature highlights certain instances in which an unjustified enrichment is subsidiary to other branches of the law,[68] although such view is not universally shared

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is inescapably normative, for it is only possible to determine whether a person's welfare has been improved after establishing a baseline from which it can be measured, and the choice of the baseline is inescapably a normative question (Andrew Kull, 'Rationalizing Restitution' (1995) 83 *Cal. L Rev*. 1191, 1235-36). Opponents of the normative approach argue that all attempts thus far in common-law jurisdictions to try to systematize and understand the law of restitution as based in unjustified enrichment – i.e, the pivotal event triggering it 'is a state of the world' – the enrichment of D at P's expense – (an attempt to give the law a structure, like Tort, by organizing it around events that make enrichment unjustified (Seavy and Scott's *Restitution*, Goff and Jones treatise, Palmer's treatise, Birks' book) have thus far been forced efforts, for, they argue, in none of these works, is possible to find a conceptual apparatus that we would expect to find in a general body of law that takes the general form of the principle 'event *x* causing outcome *y* gives rise to an obligation of D, who as an agent of *x* (or otherwise responsible for event *x*), to make amends for *y*'. Such efforts, they conclude, lack a cause-in-fact theory and a theory of legal cause to connect *x* to *y* '. It even lacks a well-worked-out rules and standards of conduct to define *x* (*x* being an event from which any resulting enrichment of B would be unjustified). That is so because, in the law of Torts (delict), for example, the events are called wrongs and the proscribed result is injury. Therefore even if it were possible to say that the concept of enrichment by impoverishment makes the causal event of D's gain P's loss, it would still look somewhat odd to speak of P's loss as a causal event of D's gain, because though the causative event is the combination of gain and loss, what in reality this event causes is the obligation to make restitution'. The contenders however acknowledge one exception where the normative theory works: In situation where the occurrence of a non-consensual transfer from P to D is made an essential element of a claim for restitution [under the heading of enrichment by impoverishment], then it is possible to organise this part of the law around the causative event of a non-consensual transfer (see Mark Gergen 'What Renders Enrichment Unjust' (2001) 79 *Texas L R* 1927, 1951).

[64] ALI *Restatement Third of Restitution and Unjust Enrichment* in 2011) and the First *Restatement of Restitution* in 1937.

[65] See for example the following recent cases still applying the same concepts: *Great Rivers Co-op of Southeastern Iowa v Farmland Industries, Inc.,* 198 F.3d 685 (8th Cir. 1999) (applying Kansas law); *Planet Productions, Inc. v Shank* 119 F. 3d 729 (8th Cir. 1997) (applying Missouri law); *Oregon Laborers-Employers Health and Welfare Trust Fund v Philip Morris, Inc.* 185 F.3d 957 (9th Cir. 1999), cert. denied, 528 U.S. 1075, 145 L. Ed 666 (2000) (applying Oregon law); *University of Colorado Foundation, Inc v American Cyanamid Co.* 196 F.3d 1366 (Fed. Cir. 1999), cert. denied , 529 U.S. 1130, 146 L. Ed 2d *956* (2000) (applying Colorado law); *Media Services Group, Inc v Bay Cities Communications, Inc.* 237 F. 3d 1326 (11th Cir. 2001) (applying Florida law).

[66] (1980) 2 SCR 834. The same approach was also used in *Sorochan v Sorochan* (1986) 2 SCR 38.

[67] Daniel Visser touches the issue in passim in his Article 'Searches for Silver Bullets: Enrichment in three party situations' in David Johnston & Reinhard Zimmermann (eds.) *Unjustified Enrichment: Key Issues in Comparative Perspective* (2003) 452-456, and a short introductory note to the issue in chapter seven on the South African perspective in Jack Beatson and Eltjo Schrage (eds.) *Cases, Materials and Texts in Unjustified Enrichment* (Hart Publishing 2003) 486 simply observes that 'It should be noted, however, that the virtually free choice of remedies in South Africa exists only when there are two parties involved. The question whether one can choose between, on the one hand, a contractual remedy against one possible defendant and, on the other, and enrichment action against the other possible defendant in a three-corned situations receives a more cautious answer'.

[68] Lionel Smith 'Property, Subsidiarity and Unjust Enrichment' in David Johnston and Reinhard Zimmermann (eds.) *Unjustified Enrichment: Key Issues in Comparative Perspective* (CUP 2002) 588. (also available at

by common law writers. The late Birks, noted in passim that 'the fact that a misdirection of funds may involve both claims in unjustified enrichment and claims to compensatory or restitutionary damages in conversion should not distract. It is a common phenomenon. English law has recently reaffirmed that it tolerates concurrence, without insisting on separating the different causes of action by doctrines of priority and subsidiarity'.[69] Because different causes of action have different characteristics at common-law, it is for the plaintiff to choose the cause to plead. In short, Anglo-American law generally recognises a narrower notion of subsidiarity, albeit its strength varies from one jurisdiction to another.

Some general trends, however, can be deduced from the organization of the law itself. First, there is generally no requirement that a person seeking restitution must proceed directly against the immediate payee or transferee of the benefit rather than a third party whose title or interest derives from the transfer,[70] except in some well defined cases.[71] Therefore the law becomes flexible and recourse to subsidiary concept to limit liability is attenuated. Secondly, some rules nonetheless have an adverse effect on the generality principle of recovery of benefits transferred where it later transpires that there was some anomaly. For example, the existence of a contractual regime between the claimant and a third party may preclude restitution from the immediate payee/transferee.[72] Thirdly, a subtle subsidiarity arises where there are potentially claims in contract and unjustified enrichment (restitution). The rule that restitution for failure of consideration is only available where a contract was discharged for breach or frustration,[73] or otherwise held to be ineffective has similar effect. It gives primacy to the contractual regime (with its valuation benefit) and only gives unjustified enrichment a role in determining the parties' rights once their own contractual allocation of risk ceases to be effective.[74]

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http://ouclf.iuscomp.org); Ross Grantham and Charles Rickett 'On the Subsidiarity of Unjust Enrichment' (2001) 117 *LQR* 273.

[69] Peter Birks 'Change-of-Position' in Mitchell McInnis (ed) *Restitution: Developments in Unjustified Enrichment* (Law Books Company 1996) 55; See also *Henderson v Merrett Syndicates Ltd* (1994) 3 WLR 761, the actual case where English law reaffirmed its tolerance of concurrence of actions.

[70] For example, we read in *American Jurisprudence* ((2003) 66 2d § 24) that 'the mere existence of a written contract governing the same subject matter does not preclude a *quantum meruit* recovery from third persons or non-parties so long as the other requirements for quasi-contract are met'. See also *U.S. v Applied Pharmacy Consultants Inc* 182 F. 3d 603 (8th Cir. 1999); *U S East Telecommunications Inc v U S West Communications Services Inc*. 38 F. 3d 1289 (2nd Cir. 1994).

[71] Among such cases is the rule that a non-compulsory payment to a creditor does not discharge the debt since that rule precludes a restitutionary action against the debtor and forces the payer to proceed against the creditor (e.g. on ground of failure of consideration).

[72] *Pan Ocean Shipping Co. v CreditCorp. The Trident Beauty* (1994) 1 WLR 161. This case concerned an attempt to recover benefits conferred on a person in the course of performing a contract with a third party. The owner of a ship chartered it and then assigned the right to payment of hire under the charter. The charter-party contained a provision for the repayment to the charterer of any hire paid for a period when the ship turned out to be off-hire. It was held that the assignee, to whom the charterer had made such payment, was not liable to the charterer, to repay the hire paid in contract or restitution. The liability to repay the hire in the charter-party remained exclusively with the party to the contract, the ship owner. For American law, see for example *R.B. Ventures Ltd v Shane* 112 F. 3d 54 (2nd. Cir. 1997) (applying NY Law); *Marple v Kurseg* 902 F. 2d 397 (5th Cir. 1990) (applying Louisiana Law); *Klein v Arkoma Production Co.* 73 F.3d 779 (8th Circ. 1996)(applying Arkansas Law); See generally 66 *American. Jurisprudence* §§ 24-26 (2003).

[73] Gerald McMeel *The Modern Law of Restitution* (Blackstone Press 2000) 130. The author also discusses modern criticisms of such a rule.

[74] Jack Beatson and Eltjo Schrage (eds.) *Cases, Materials and Texts in the law of Unjustified Enrichment* (Hart Publishing 2003) 426.

While that description applies to all common-law jurisdictions in general, the American experience is somewhat peculiar. The trend there in sub-contractors' cases, or in other three parties' cases in general, is not to favour liability. However, this general rule is really *prima facie* only. The rule is often qualified in practice either directly by judicial decisions, or academics in general doubt its unqualified application. The rule on subcontractors in most States is clearly captured in Dobbs Law of Remedies[75] as follows:

Rule 1: The subcontractor is generally not entitled to a restitution claim against the landowner. *Rule 2*: A subcontractor is however, entitled to enforce his claim against any funds still held by the landowner but which are owed to the general contractor.[76]

How should we read the rule as presented by Dobbs? Is really the general norm stated in rule 1 a clear-cut one? If read together with rule 2, it becomes clear that the rule in item 1 establishes a very limited principle. Reading both rules together shows that a plaintiff A in such scenarios cannot recover from C –the owner – if C has paid the main contractor. If on the other hand, C has not really paid the main contractor, then a claim based on restitution (or unjust enrichment) is clearly actionable. Under what conditions such an action is allowed in practice? There is no universally accepted idea in the cases. Generally, however, the courts use a three fold inquiry: first they pose the question as to whether the defendant (in most cases the owner) was in facts enriched. Secondly, if the answer is affirmative, then the following question follows: was the enrichment unjust? Thirdly, is there sufficient causal link between defendant's (owner) enrichment and the plaintiff's loss? In other words, is whether the defendant's enrichment is 'at plaintiff's expense.

In short, the position in American law is that subcontractors' enrichment claims against owners are allowed if the owner would benefit from the subcontractor, but there is no direct contractual relationship between the owner and the subcontractor. The mechanisms, however, how such claims are raised are not very clear.

3 Revisiting the roots of an old concept. How does *Palabora* case fit in?

Current multiple interpretations and models of subsidiarity ranging from those based on mere policy considerations to philosophical, political and historical reasons, sometimes have little to do with legal reasoning. Examining closely the various approaches reveals that they engender more confusion than clarity. The old French cases that gave birth to subsidiarity rule did not always do so with convincing reasons. They often produce more inconsistencies than clarity.[77] The judgments[78] in which the *Cour de Cassation*

[75] Dan B Dobbs, *Dobbs Law of Remedies* Vol 3 2nd Ed (West Publishing Co 1993).
[76] Dan B Dobbs *Dobbs Law of Remedies* Vol 3 2nd Ed (West Publishing Co 1993) 470.
[77] Here are just a few conflicting reasons advanced for the concept and based on the same authorities: (i) Demongue says that «la seule raison en faveur du caractère subsidiaire est celle de l'économie des moyens, il faut éviter l'action d'enrichissement quand on a une voie plus simple» [the only reason in favour of subsidiarity is that of economy of means; it is necessary to avoid an enrichment action if there is a simpler way to achieve the result] ; (ii) Renard denying its subsidiarity character, but explaining the same cases (below *arrêts* de 12.5.1914 and 2.3.1915) by means of the causa requirement says: 'c'est plutôt pour des raisons de fait sans rapport avec la nature de l'action *de in rem*

says expressly that the plaintiff may not have at his disposal '*pour obtenir ce qui lui est dû aucune action, naissant d'un contrat, d'un quasi-contrat, d'un délit ou d'un quasi-délit',*[79] are usually considered as the 'authoritative' remote pronouncements for the notion of subsidiarity. However, these judgments may also be exhaustively explained without any appeal to any other action. Arguments were advanced that in the first judgment an appeal is made to enrichment because of performance. In the second judgment the enriched party enjoyed the enrichment as a result of his position as a creditor.[80]

Certainly the formula used summarises all the requirements as formulated in Aubry and Rau and taken over in *arrêt Boudier* and the *Cour de Cassation* in these two *arrêts* above (*Clayette* and *Briauhant*). The judgments intended to accord a certain kind of subsidiarity to the actio *de in rem verso*. But what kind of subsidiarity is it? The formulation adopted allows different interpretations. For example, explanations in French texts on Obligations in general[81] and specifically those referring to Aubry and Rau such as Bartin's work[82] do not offer any certainty on the issue. Bartin's opinion is that Aubry and Rau's formula can be interpreted in three different ways: Firstly if another action exists, whether against the same person or against another person, there can never be an *actio de in rem verso*. Secondly, if such action exists, there can only be an *actio de in rem verso* if this action has become legally ineffective. Thirdly, except in the case mentioned under the second possibility, the *actio de in rem verso* is admissible, if the other action has become practically worthless due to the insolvency of the debtor. Bartin leaves here the choice between the views given open to the reader. He does however point out that, in his view, an enrichment action is excluded, if the impoverished party has a contractual action at his disposal. The same threefold interpretation appears in Flour and Aubert.[83]

In South Africa Visser also advocates a threefold enquiry in subsidiarity understanding, albeit slightly different from Bartin's interpretation above. Again, Jooste's analysis notes four approaches to this notion, adding yet another difficulty. The first three notions of subsidiarity in Jooste's[84] assessment largely correspondent to the elements discussed above. They simply reflect the Franco-Italian approaches. But Jooste adds a

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verso qu'on peut parler du caractère subsidiaire de l'action'. And explaining the same cases on the basis of *causa* requirement concludes: 'la situation contractuelle exclut inter partes l'action *de in rem verso* pour tout deplacement patrimonial ayant sa source dans le contrat même' [It is rather for reasons that have nothing to do with the nature of the *actio de re in verso* that one may speak of the subsidiary character of the action'; (…) 'a contractual situation between the parties excludes the *actio de in rem verso* for any patrimonial shift whose source is the contract itself']. (See generally English translation of Marcel H Bregstein, Dissertation, *Ongegronde Vermogensvermeerdering* (PhD Thesis, Amsterdam (1927) 260-261) in Jack Beatson and Eltjo Schrage, *Cases, Materials and Texts in the Law of Unjustified Enrichment* (Hart Publishing (2003) 461-464.

[78] *Arrêts* de 1914 (12.5.1914) (para. 14) (*Clayette* case) and 1915 (2.3.1915) (para. 15.5) (*Ville de Bagnères-de-Bigorre v. Briauhant*).

[79] […To obtain what is due to him, any action arising from a contract a quasi-contract, a delict or a quasi-delict].

[80] See Marcel H Bregstein, Dissertation, *Ongegronde Vermogensvermeerdering* (PhD Thesis, Amsterdam 1927) 260-261) in Jack Beatson and Eltjo Shrage *Cases, Materials and Texts in the Law of Unjustified Enrichment* (Hart Publishing (2003) 462.

[81] Jacques Flour and Jean-Luc Aubert, *Les Obligations: Vol. II - Les Faits Juridiques* (Dalloz 1994) 52-55.

[82] Etienne-Adolphe Bartin (ed.) Charles Aubry and Charles Rau, *Droit Civil Français* 5th Ed. (Marchal et Billard 1897-1922) para. 578 note 10.

[83] Jacques Flour and Jean-Luc Aubert, *Les Obligations: Vol. II- Les Faits Juridiques* (Dalloz 1994) 55.

[84] CM Jooste, 'Compensation for Improvements by Tenants in South Law' in Eltjo Schrage (ed) *Unjust Enrichment and the Law of Contract* (2001) 257-274, 270.

nuanced interpretation borrowed from two Dutch scholars, Snijders and Hartkamp.[85] These scholars refer to a 'practical' or 'factual' subsidiarity which allows lawyers first framing their pleadings in contract or delict, for instance. Thereafter, as a last resort, pleading a final alternative claim – as if it were an afterthought – dragging in the enrichment idea. This in fact is nothing more than a procedural subsidiarity. Visser's approach also envisages such subsidiarity implicitly when he mentions his third leg with claims in the alternative.[86] Jooste however adds a fourth conception, which apparently is in contrast with the other three in that the previous ones are all framed in the negative. 'All of them determine when an enrichment is (at least not primarily) competent, but they do not tell what an enrichment claim can do'. Jooste's fourth 'subsidiarity' conception, however, is 'both theoretical and positive'. Theoretical because of it 'concerns with the taxonomic status of enrichment law within the entire legal system'.[87]

How does the case *Palabora Mining Co v Coetzer* fit[88] within this enrichment liability approach?

In brief, the facts of this case were as follows:

The plaintiff, Mr Coetzer had been employed by *Palabora Mining Co* (the Mine). The Mine provided him with rented personnel accommodation as part of his employment package. He was at some point dismissed by the Mine (allegedly unfairly so) and evicted from the leased premises. While in occupation of the leased premises, he had built a swimming pool with an apparently horrendous 'Blue Grotto' effect concrete superstructure. He now wanted compensation from the Mine for the alleged improvement to the premises.

The facts above clearly establish an enrichment. But is it an actionable enrichment? If the subsidiary rule just analyzed is recognized under South African law based on Roman-law tradition, such circumstances of improvement to another's property 'without their express consent', the claim would require the principal's express consent (which was lacking in the event). Alternatively, it would require, at least a 'tacit consent/ 'free acceptance/acquiescence' (in English terminology) (which was apparently the case, though uncertain). A third avenue is to argue that the expenses were such that he Mine as owner would have (been able) to make them themselves. What is then the most desirable approach?

For Jooste, *Palabora* case fits adequately into enrichment liability. This fact-pattern invites a general enrichment action to cure the defects in the system. That is so because as long as there is some sort of say, tacit consent the facts should be actionable.

[85] CM Jooste 'Compensation for Improvements by Tenants in South African Law' in Eltjo Schrage (Ed) (2001) 270.
[86] Visser says: 'If however, the jurisdiction allows only one of the actions, that action is not subsidiary to the other possible actions, but alternative' (Daniel Visser, 'Unjustified Enrichment' in Jan Smits (ed) *Elgar Encyclopedia of Comparative Law* (Edward Elgar Publishing 2006) 772). Though what Visser envisages here is objectively a substantive issue, it nonetheless raises the procedural issue, because for the alternative to be available to the claimant, it must be pleaded. That is what really a practical or factual subsidiarity means, although procedural rules may prevent it from being pleaded at a later stage.
[87] CM Jooste 'Compensation for Improvements by Tenants in South African Law' in Eltjo Schrage (ed) *Unjust Enrichment and the Law of Contract* (Kluwer 2001) 270.
[88] (1993) 3 SA 306 (T).

Alternatively, where the requirement laid down by a Celsus-Voet[89] approach are met in circumstances an action should lie. All that is required is that the judge be satisfied that beneficiary 'would have made such improvements himself'. Or 'that these kinds of expenses should fall within the normal pattern of expenditure'. An enrichment claim in such a case 'harmonises with, and does not subvert, the general idea of contractual liability as based on consent'.[90] Allowing the improver of another's property a claim should not be totally out of proportion to what would or could realistically have been contemplated between the parties themselves'.[91]

Applying this 'positive subsidiarity' to the facts in *Palabora Mining Co v Coetzer* Jooste however resorts to a highly discretionary approach apparently based on the Celsus-Voet approach above. He says:

'Certainly the mine being famously wealthy, they could afford it, and what is more, it probably would have been an immediately realisable benefit in the form of higher potential rental accruable. A swimming pool is certainly not a luxury item in *Palabora*, which is scorchingly hot and dry hell-hole with temperatures often in the higher thirties. There is therefore, in the circumstances of the case, nothing in terms of the subsidiary principle which would defeat the lessee's claim. It would have been different if, for instance the owner had been of modest means, or was not in his or her general course of affairs in the business of re-letting' the property, or if the home were situated in a climate hostile to recreational outdoor swimming'.[92]

What to make of this analysis?

Certainly most legal systems generally accept that where there is a subsisting contract between two parties, claims in unjustified enrichment are excluded. However, this observation should never be taken at first value. It is an oversimplification. There are instances in which enrichment claims are allowed in the presence of a valid contract. Such happens either because the contract does not speak to the status of the benefit in question,[93] or in other cases, the enrichment claims are denied, even though the parties'

[89] Celsus in D 6.1.38 'Suppose that the owner is a poor man who, if forced to pay such a sum [as compensation for improvements effected by a bona fide possessor], would have to give up his household gods and ancestral graves, it would be sufficient that you be allowed to remove what you can of the building materials…'; and Johannes Voet *Commentarius ad Pandectas* (Johannem Verbessel 1698-1704) 6.1.36 'Exceptions –'to the bona fide possessor recovering his expenses to the extent of the enhanced value are where such expenses are too heavy and the owner himself would not have incurred them. In that case he merely removes the results so far as he can…'.

[90] CM Jooste'Compensation for Improvements by Tenants in South African Law' in Eltjo Schrage (ed) *Unjust Enrichment and the Law of Contract* (2001) 270-271.

[91] Idem, 271. See however Article 1592 of the Italian Civil Code saying that the 'tenant is not entitled to restitution for improvements made without previous authorization of the lessor'. Obviously Jooste defends the applicability of the enrichment remedy in the circumstance based on what he calls 'tacit consent' or the Celsus-Voet approach (D.6.1.38 and Voet 6.1.36) or alternatively a justification analogous to the English 'subjective devaluation' or 'free-acceptance' principle.

[92] CM Jooste 'Compensation for Improvements by Tenants in South African Law' in Eltjo Schrage (ed) *Unjust Enrichment and the Law of Contract* (Kluwer 2001) 271.

[93] See for example the Canadian case *Hoffman v Sportsman Yachts Inc*, 89 DLR (4th) 600 (1992), (Ont.CA); The American cases *Toolrend Inc. v CMT Utensiles SRL* 198 F.3d 802 (11th Cir. 1999) (applying Florida law); *Elliott v Joyce* 889 P. 2d 43, 53 ALR 5th 791 (Colorado 1994) holding that a remedy of *quantum meruit* exists independently of any contract claim); for South Africa see *ABSA Bank v Stander* (1998) 1 (SA) 939 (CPD) and *Hubby's Investments (Pty) Ltd v Lifetime Properties (Pty) Ltd* (1998) 1 SA 295 at 298H-J where Cloete J held 'A right of retention cannot exist *in vacuo.* If there is a right of retention, there must be an action' and the explication that follows that assertion at 298J-299A-E.

contract no longer exists, because the now-discharged contract speaks to the status of the benefit in question.[94] Yet in other instances, what is required is simply that there is no inconsistency between the remedy in unjustified enrichment[95] and what would have been recovered had a breach of contract claim been pursued. In all these scenarios the defendant must not suffer injustice for allowing the unjustified enrichment remedy.[96]

In the instant *Palabora* case, no such injustice would arise though the facts do not square entirely with a proper contract, as a tenancy was terminated. The rule can still be applied similarly to a normal three party contractual scenario. There are further arguments supporting the contention that the contract-bar rule is not universal.

Therefore subsidiarity of enrichment claims to contractual claims cannot be assumed without qualification. On the issue of risk allocation, modern trend advocates that the contract-bar should only apply if the contract has allocated the risk of the event giving rise to the enrichment onto one of the parties. If there is a gap in the contractual allocation of them the subsistence of the contract is no bar to a claim in unjust enrichment.[97]

4 Conclusion

In conclusion, the analysis of the subsidiarity rule where there is interaction between contract and enrichment liability seems to yield the following result: there are usually two main groups of cases. One group is normally based on what I call 'defective consent'. The other group is based on policy considerations. Being this the case, it is safer to say that unjustified enrichment claims, based on defective consent, as opposed to those based on policy considerations alone, will not be allowed when there is a consensual distribution of risks and rewards. Put differently, the principle of subsidiarity must be operative at least in these last cases.

Seen from a corrective basis of enrichment liability, the exclusion of enrichment claims where there is a consensual distribution of risks and rewards, or what the parties have bargained for, the consensual distribution normatively operates to validate any transferred benefits and eliminates any prospect of normative gain or loss. This perspective leads to two consequences: The first is that a policy-based claim for unjustified enrichment can be made even in the presence of such a bargain because the normative flaw in the transaction is not inconsistent with the consensual bargain. The second consequence is that the perspective provides a positive reason for excluding unjustified enrichment claims (at least those that are not policy-based) whenever there is

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[94] Jack Beatson, 'Restitution and Contract: Non-Cumul?' (2000) 1 *Theoretical Inquiries in Law* 83; See also Daniel Visser, 'Search for Silver Bullets: Enrichment in Three Party Situations' in David Johnston & Reinhard Zimmermann (eds.) *Unjustified Enrichment: Key Issues in Comparative Perspective* (CUP 2002) 526).

[95] *American Jurisprudence* (2d 2001) Vol 66, p 624. It is also with similar reasoning that the South African judge in *ABSA Bank Ltd v De Klerk* (1999) 1 SA 861 (W) says: 'Mr Roos has requested judgment on the alternative claim. If my assessment of the situation is correct the reason is obvious: The choice of relief in fact lies with the plaintiff. Nothing in law compels me to exclude the alternative claim merely because the plaintiff made the *condictio indebiti* its main claim.

[96] *U.S. v Applied Pharmacy Consultants, Inc* 182 F. 3d 603 (8th Cir. 1999).

[97] Ralph Cunnington, 'Failure of Basis' [2004] *LMCLQ* 234, 251.

a bargain.[98] However, this conclusion is normally operative where there is a clear recognition of a general principle against unjustified enrichment.

The defence of change of position in unjustified enrichment law has nothing to do directly with the issue of enrichment liability as such. The defence properly analysed relates to the extent of the remedy which is awarded rather than to the negation of the plaintiff's cause of action. However, a careful analysis of the way in which liability is structured or constrained in a particular legal system shows that there is an impact on how the defendant may resist a plaintiff's claim. Because the doctrine of subsidiarity tends to deny plaintiffs' claims outright at the liability stage, the outcome is that the defendant may find himself with an undue windfall because the claim was prevented. That is of course 'good news' for the defendant. In such circumstances, the doctrine of subsidiarity unfairly places the risk on the plaintiff, should he be faced with unexpected difficulties in proving that the enrichment was *sine causa* and the other action being worthless pursuing.

However the notion of subsidiarity affects the defendant alike. Once the plaintiff has established a cause of action at the liability stage, generally then the onus shifts to the defendant in all enrichment claims. The defendant must now establish that it is inequitable for the defendant to make restitution because of the change of his position. Because the onus is now on the defendant, he has a chance to defend himself with all means. That being so, if a claim is not allowed at the liability stage, for being constrained by the doctrine of subsidiarity, the outcome is that either the defendant is freed totally from any liability, or if the claim is sanctioned in any other way, the plaintiff's measure of recovery may be flawed to the detriment of the defendant, because the other measures may not take into account any alteration in the defendant's circumstances. Therefore the concept of subsidiarity (specially an unqualified subsidiarity) leaves the assets of innocent and *bona fide* defendants vulnerable.

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[98] cf. Stephen A Smith, 'Concurrent Liability in Contract and Unjustified Enrichment: The Fundamental Breach requirement (1999) *LQR* 345; Daniel Visser, 'Rethinking Unjustified Enrichment: A Perspective of the Competition between contractual and Enrichment Remedies' (1992) *Acta Juridica* 203, 231-36.

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LINK BETWEEN KNOWLEDGE MANAGEMENT AND HUMAN RESOURCE MANAGEMENT

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ABSTRACT

This paper presents a brief literature review of both Knowledge Management (KM) and Human Resource Management (HRM) and demonstrates the link between them. We acknowledge the role of Intellectual Capital (IC) in bestowing competitive advantage to any firm and thus contributing towards its success. The paper also explores the role of KM and HRM both in sustaining IC particularly in the case of hiring for employees' replacement. Further, it also explains the relationship of HRM's main domains such as: selection, training, appraisal and rewards with KM in detail and their roles in the effective installation of KM system. Based on the extant literature, it reinforces (argues) that a new worker could be transformed to a knowledge-worker if appropriate transition processes were in place for knowledge retention and captured from leaving personnel. These knowledge-workers may be considered as talents that need to be nurtured under a suitable Human resource environment that supports the KM system. This paper confirms that the learning organizational structure provides conducive environment for knowledge-workers to realise his/her potentials. Finally, it concludes that if HRM is well linked to KM, then the replacement of employees may not be considered as a knowledge retention and capture problem for any firm.

Keywords: Knowledge Management, Human Resource Management, Intellectual Capital, Knowledge Worker, Knowledge Retention and Capture

INTRODUCTION

Unarguably, Knowledge is one of the key elements in sustaining the organization's success. A thorough knowledge of current systems at work leads to effective planning for future. Sustaining knowledge certainly needs a proper management and hence knowledge management is one of the important subjects in the organizational field. While, many organizations have developed the tools needed for managing and sharing knowledge within their employees by exploiting technology still a large number of them struggle to share knowledge with staffs. The literature about the issues of Knowledge management and the role of using technologies in managing knowledge is fairly rich and has been investigated at many levels. However, the literature of

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Knowledge Management itself and its link with Human Resource Management is sparse (Afiouni, 2007; Haesli and Boxall, 2005; Har et al., 2010 and Maqsood, 2006). This paper contributes by investigating that link and attempts to clarify the importance of Human Resource Management themes for managing knowledge in order to achieve the sustainable success for organizations.

Knowledge Management and Intellectual Capital

Intellectual capital (IC) is an organizational asset, which provides competitive advantage. The proper management of IC has a significant impact in supporting and sustaining business life cycle. Nahapiet and Ghoshal (1998) define IC as "a valuable resource and a capability for action based in knowledge". Ulrich (1997) maintains that when effectively managed, IC may assist in achieving success and enhancing organizational survival and suggests that, Human resource (HR) departments should take the lead in dealing with IC. He also claims that this success might depend on attracting and developing individuals in order to retaining them. Further, Edvinsson and Malone (1998) classify IC into three categories: (a) Human capital: the organization's workers, (b) Structural capital: the organization's systems or work processes and (c) Customer capital: the relationship between the organization and its customers

Each category reflects key assets for any organization. Clearly, they focus on two main subjects: knowledge ("know what") and people ("know how"). Further, Davis (2009) suggests a "close link" between IC and the core process of knowledge (acquisition, codification, sharing, development and application).

Petersen and Poulfelt (2002) define KM as "the process of developing, sharing and applying knowledge within an organization to gain and sustain competitive advantages". Drucker (1993) supports the argument which KM is the only way to attain competitive advantage in this age. Further, Barney, (1991) suggests that gaining and sustaining the competitive advantage -"Knowledge" is related in the first place on human resources management, because human resources are considered the most critical aspect of organizational success. Ulrich (1997) opines the same about human resources. Even, Davenport and Völpel (2001) mention that managing knowledge is equivalent to managing people. When put together, evidently, there exists a relationship between knowledge and human resources. Dealing appropriately with just one of them and ignoring the other might negatively affect the successful implementation of a system that depends on knowledge and people. Storey and Quintas (2001, p 344) say "It is a paradox that, while so many authorities and commentators on knowledge management (KM) have come to the conclusion that KM ultimately depends upon people, it is precisely the people (or HR) aspect that has been the most neglected in studies in this field". Hislop (2003) explains that KM and HRM integration is still not complete and effective. Chen and Huang (2008) suggest that both human resource management (HRM) and KM strategies need to be integrated to derive benefits from the IC and thus increase the organization's performance and achieve success. While the KM literature acknowledges the importance of people management themes, still it has not reached the next step of investigating and theorizing them in detail. Clearly, though HRM and KM are established management concepts, the significance of HRM in KM is only partly realized. Ruggles (1998) includes research conducted on a 431 U.S. and European organizations, and concludes that most organizations acknowledge that knowledge is highly people-based yet these organizations' efforts in KM are towards technology implementation. Though

organizations can facilitate creation, sharing, and knowledge transfer by having the latest and newest technologies; yet their effectiveness in managing KM is not absolute (Hislop, 2003). May be the integration of HRM with knowledge management has not been completely achieved primarily due to a lack of studies relating KM with IT.

In conclusion, in order to achieve success and optimum benefits from its resources, it is vital for the organizations to pay more attention to their internal capabilities, specifically people and their knowledge. The aim of this analysis is to show how strong links between KM and HRM may affect the ways organizations hold knowledge and assist the staff replacement process. To our knowledge, there exists no prior research related to staff replacement on a nationwide scale. This research attempts to fill this gap and to help understanding the links between KM and HRM.

Thus far we have established that Human Resources Management has strong relations with Knowledge Management and that gaining the competitive advantage of "knowledge" is all about managing, developing and retaining people. It also implies, that losing people is equivalent to losing knowledge.

Role of HRM strategies in effective KM:

Influencing human resources towards knowledge sharing is a key to KM. Soliman and Spooner (2000) emphasized that employees' involvement, commitment, and trust will foster the application of KM. This involvement can also be controlled and managed under Human Resource Management (HRM). Shih and Chiang (2005) also argue that to achieve the main goal of KM, which is effective knowledge transfer, organizations' HRM strategies and practices should play the central role in knowledge management. Hence, the role of HRM practices in facilitating knowledge absorption, creation, sharing, and transfer is critical. HRM strategies need to be aligned with the corporate and KM strategies to derive consistent competitive advantage.

Shih and Chiang (2005) argue that the adoption of proper HRM strategy and practices facilitates the successful implementation of a KM strategy. They also suggest a model. For instance, if corporation has a cost-leadership strategy, the KM strategy would be a codification strategy and the HRM strategy would be buy-bureaucratic HRM strategy with close supervision and high control to minimize cost of errors, result-oriented performance, limited training, etc.

According to Storey (1989), the traditional HRM domains revolve around selection, training, appraisal, rewards, and performance management systems. These HRM domains take a "different colour" when they contribute to organizational knowledge assets (Narasimha, 2000). According to Storey and Quintas (2001), HR professionals confront five key challenges in dealing with knowledge: developing and sustaining the knowledge culture in the organization, accessing employees' tacit knowledge, securing trust and commitment between employees, handling non-traditional employees such as knowledge workers, and "handling the organizational vulnerabilities arising out of a heavy dependence on key knowledge workers" (Afiouni, 2007).

All the discussion thus far highlights issues related to employees more than knowledge system itself and suggests that HRM strategies need to be equipped with knowledge processes in order to achieve effective KM. The next few sections evaluate HRM domains and their effects on KM.

Selection process and KM:
Organizations adopt highly advanced and complex methods of selecting and recruiting employees to attract the best talent in the market. To create a knowledge repository and increase the benefit of sharing knowledge between employees, selection of individuals with competent skills and the right attitude is essential. Highly innovative selection processes have been introduced that are technologically sound and efficient (Scarbrough, 2003). Selection processes are customized to the job descriptions and corresponding skills and competencies that ensure the right candidates are hired for the job. However, such customized selection processes can conceal certain employee behaviours as mentioned by (Narasimha, 2000).

Training and Knowledge Management:
Training activities are regarded as core knowledge sharing processes. The most important practices adopted by HRM are KM processes. Training is a process that directly connects HR personnel with other employees in order to source knowledge transfer, which stands at the core of any KM process. Training also plays an important role in the development of the three dimensions of organizational knowledge: breadth/depth of knowledge, competence, and exploratory/exploitative knowledge (Narasimha, 2000). Training provides an opportunity to improve employee performance through work-related knowledge and skill-development (Swanson, 1999). Tacit and explicit knowledge related to skill-specific work can be transferred through systematic and frequent training (Robertson and Hammersley, 2000). Har et al., (2010) hypothesized that training leads to higher knowledge transfer. Frequent training that supplements organizational knowledge can be accomplished by creating a learning culture. In conclusion, training is a practice that improves competitiveness, enhances technical and social learning, results in knowledge acquisition outside one's main domain, and improves overall business performance.

Performance management and KM:
Performance management processes can make an important contribution to knowledge management by setting behavioural expectations related to knowledge-sharing, ensuring that actual behaviours are reviewed, and where appropriate, establishing financial or non-financial rewards (Armstrong, 2006). Performance appraisals aim to provide role and goal clarity to individuals, and are key process by which employees' performance and improvement is assessed. Soliman and Spooner (2000) posited that HR can drive KM by evaluating employee performance, providing feedback for leadership, enhancing the decision making capabilities of individuals, creating interpersonal relationships, minimizing high turnover and absenteeism, and clarifying roles and goals. Performance appraisals should be designed to evaluate the degree of usage of competencies, which can be taken as indication for further training and development (Narasimha, 2000).

Rewards and KM:
The means to improve knowledge sharing have to be motivational, and rewards and recognition must improve employee motivation and commitment. Har, et al. (2010) suggested that learning behaviours should be rewarded when performance is achieved in order to avoid negative effects on employees' performance and failure to achieve desired outcomes. Furthermore, Bartol and Srivastava (2002) emphasized that reward structures are necessary to motivate people to communicate and to share their knowledge. Employee commitment and willingness to share are critical to knowledge sharing processes. Employees can be motivated to share knowledge through rewards

and recognition (Storey and Quintas, 2001). Moreover, motivation by rewards and recognitions will assist in encouraging innovation in different aspects such as products, services or communication style between staff. Knowledge sharing that is backed by a reward system is an excellent tool to install KM in an organizational culture through group performance, knowledge sharing, and innovative thinking (Yahya and Goh, 2002).

Knowledge worker and Talent Management in learning organization:

Talent management is one of the most important concepts in contemporary management that is pressured by globalization issues, immense competition in labour market, vast advancements in information and technology and enormous struggle to compete in businesses. According to Serrat (2010; p.3), talent management can be consider as an "additional processes and opportunities" that an organization can make available strategically to a group of people who are "deemed to have talent".

Serrat (2010), asserts that the ignorance of talents from human resource management in any organization can be consider as "untapped quality to be accessed in the future" or unused efforts that the organization can benefit from in the future which will have an effects on both; talented staff and the organization.

These statements show the significance of talent management. Knowledge worker can be considered as a talent for the knowledge that s/he obtains. Drucker (1999) refers to knowledge workers as capital and not labour. Employees with specific skills and talents can use their ideas and expertise during turbulent times, which can add great value to organizations during such challenging situations (Lawler, 2008). Talent management of knowledge workers is highly essential as it creates value for their knowledge; it creates systems and procedures that track and manage the talented personnel. Bano et al., (2010; p.7) assert, 'The organization which is dealing with the management of talent strategically and purposefully explains that how they attract, source, select, develop them by trainings and ultimately retain them by promoting and rotating them throughout the organization.' Knowledge workers' turnover is a major challenge to firms because when the knowledge workers leave, they take along their tacit knowledge. Even if firms develop highly sophisticated codification processes to tap employee knowledge, these processes cannot capture the employees' willingness, attitude, and passion for knowledge. Hence, the focus of HR towards talent management of knowledgeable workers should constitute appropriate selection, rewards and training beside KM processes.

The knowledge workers are a part of the human capital that is developed through continuous learning and innovation. A learning atmosphere that provides flexibility and a holistic learning opportunity for knowledge creation and sharing is most favourable for knowledge workers (Storey & Quintas, 2001). A learning organization instills learning behaviour in their culture; they have a supportive and encouraging leadership; strong information and technology base; strategically aligned rewards and performance management system; and constantly strive for employee retention (Nelson & McCann, 2010). Organizational culture influences the behaviours required for KM in four ways. Firstly, it educates people about KM and highlights the critical knowledgeable aspects. Secondly, it establishes a relationship between individual and organizational knowledge. Thirdly, it creates framework for network processes for fostering knowledge sharing and usage. Lastly, it shapes processes for creation, sharing, and usage of new knowledge.

As discussed above, there is a strong relationship between KM and HRM. These issues have not been thoroughly explored, nor has the relationship or its effects on retaining knowledge been documented. Furthermore, in spite of the immense work related to KM strategies for knowledge retention via IT systems and tools, knowledge retention along and employee recruitment or replacement remain one of the core strategies that have not yet been developed (Wong, 2008).

Forcing a company to replace its employees can have significant effects on the company's success. Employee turnover can potentially cause knowledge loss. This issue is going to happen in one of the Middle East countries. In Saudi Arabia, the new localization program "NITAQAT" that launched by the Ministry of Labour last June 2011, which aim to replace foreign workers in the country with locals" will lead to the export of a huge amount of knowledge outside the country. Replacing foreign workers with domestic labour will take place on a nationwide scale, and the foreign workers' knowledge, which could be considered as the most valued asset in this stage, will be lost. This loss of institutional knowledge will affect the country on many levels, including economically and socially.

In order to transfer foreign workers' knowledge successfully to the local labour market, the country should act soon to retain the needed knowledge and maintain the competitive advantage of IC. This can be accomplished by using the benefits of good KM strategies for firms/organizations with the right strategies and practices of HRM and applying them on a larger scale.

CONCLUSION

The effectiveness of HRM in sustaining KM, and the role of both KM and HRM in supporting employee replacement processes, is the main goal of this paper and it is a part of a PhD study that will study the Saudi Arabia's new localization program "NITAQAT". This research will further examine these strategies in order to understand the impact of KM strategies and HRM strategies on organizational effectiveness. In order to avoid losing knowledge while maintaining the competitive advantage of IC, the study will investigate KM-HRM links in order to assist the employee replacement process. Moreover, the study aims to test the current status of the Saudi Arabian organizations and its ability to adopt KM and HRM links.

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REUSE OF DOMAIN KNOWLEDGE TO INCREASE ADOPTION OF OFF-SITE MANUFACTURING FOR CONSTRUCTION IN AUSTRALIA

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ABSTRACT

Many construction industry decision-makers believe there is a lack of off-site manufacture (OSM) adoption in Australia. Identification of construction business process to assist decision-makers to increase OSM adoption is a proposed solution. The premise that domain knowledge can be re-used to provide an intervention point in the construction process led a team of researchers to develop base-line process models for a generic construction project. Sixteen domain experts in the Australian construction industry were asked to review the base-line process model related to Arranging the Project Team by answering the question "Where in the process illustrated by this base-line model has OSM implications?". Through an iterative and generative process a number of off-site manufacture intervention points were identified and integrated into the base-line process models. The re-use of industry expert domain knowledge provided suggestions for improvement to current practice. It is expected that implementation of the new processes will lead to systemic industry change and thus increases adoption of OSM.

Key words: Australia, construction knowledge reuse, OSM adoption.

INTRODUCTION

Off-site manufacturing (OSM), off-site assembly, off-site fabrication and prefabrication are modern methods of construction. For simplicity in this paper OSM is used to indicate a number of different process types that take place distant from the construction site. There are a numbers of factors that foster the adoption of OSM according to the extensive literature (Nadim and Goulding 2011; Blismas and Wakefield 2009; Goodier and Gibb 2007). OSM offers better waste control through coordination and use of a controlled environment. In times of skills shortages, OSM

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can solve the problems of limited on-site workforce availability. In addition, repetitive standardised processes, such as constructing door frames, can be controlled for quality more effectively using a single manufacturing facility. However, OSM adoption is still limited outside of the residential housing sector (Nadim and Goulding 2011; Blismas and Wakefield 2009). Rodriguez-Melo and Mansouri (2011) suggesting that stakeholders, including clients, architects, engineers, project managers, builders, contractors and suppliers are unable to make decisions to utilise OSM due to the lack of understanding OSM processes (Goulding et al. 2012; Kenley et al. 2012).

Smith (2010) however, suggests that some construction stakeholders do have specific domain knowledge concerning OSM processes, but do not effectively share this knowledge with other project stakeholders. Sharing domain knowledge can facilitate problem-solving and decision-making that enables cost trade-offs thus improving manufacturability and increased product quality (Lawson, et al. 2009). Domain knowledge is a defined concept in a number of disciplines such as education, psychology, engineering, and information technology (Vitharana et al. 2012). The concept is widely used with multiple meanings: cognition, language acquisition, professional practices, institutional processes and information systems.

The common thread for application of the concept of domain knowledge is that individuals, groups, organisations and temporary organisations such as construction projects can create, store, disseminate or reuse specific process knowledge. In the construction industry most of the expert knowledge is related to occupational domain knowledge such as engineering or project management. Thus one mechanism of providing support for increasing adoption of OSM could be linking specific domain knowledge about construction off-site manufacture with current construction projects processes. However, many studies have shown that individuals, teams and organisations become ‘experts’ about specific tasks and processes, but often with limited ability or desire to reuse that knowledge for change (Kanjanabootra 2011).

Self-interest and competitive advantage are often cited for lack of knowledge sharing, but studies also indicated that knowledge sharing has a positive net effect (Harfield 1999). This is especially true in relation to innovation or changes to traditional industry practices (Kanjanabootra and Corbitt 2010; Heywood and Kenley 2008). The difficulty appears to be that individual domain knowledge cannot be reused and applied outside of the knowledge process framework of an individual unless specific mechanisms are in place to facilitate that domain knowledge reuse.

For example, Heywood and Kenley (2008) introduced a competitive advantage framework for corporate real estate. Their study reports that managers knew about CRE functional practices such as financial management and resources allocation, but they did not know how to reuse this knowledge for competitive advantage practices. In one part of the framework the authors provide a competitive advantage framework (fit to purpose) for location selection. This new dimension to the decision-making processes assists managers in developing strategy, which has now become a core CRE activity. In much the same way, this study aims to provide OSM adoption

frameworks for construction industry stakeholders in Australia to re-use their domain knowledge.

RESEARCH DESIGN

The aim of the study is to develop a mechanism to facilitate domain knowledge re-use through domain knowledge sharing concerning OSM adoption for construction projects. Specifically the research focuses on development of construction project process models to provide the framework for the reuse of construction stakeholder domain knowledge (Demian and Fruchter 2006.

Business Process Management

Business process management (BPM) systematically documents, manages, automates and optimises business processes (Weske, 2007). This is achieved by promoting a process-centric view of an organisation through end-to-end management of business processes. Business processes are activities in a sequence that have conscious or un-conscious decision-points linked to them. For example, when we go into a bank to deposit money the teller takes our money and provides us with evidence of the transaction. The money goes into a specific drawer, in a set order, and a copy of the transaction is entered into a computer database. These sequential activities are called 'depositing'. These activities involve human interactions and decision-points throughout the process of depositing. These activities are also linked to other business processes, which make up the complexity of process we know as 'banking'. From a process perspective, all organisations, industries and projects are sets of inter-linking processes providing frameworks within which business operates.

The purpose of business process management is to identifying processes in order to provide the mechanism for change. The BPM lifecycle typically has a number of distinct phases: design, implementation, enactment and diagnosis with the intention of creating an IT system change mechanism (Dumas et. al 2005). Each of process identification lifecycle phases are generative and iterative (Holliday 2007). For example, during the design phase, the process requirements are gathered from stakeholders (multiple viewpoints) resulting in an initial set of base-line process models. These models are used for further communication with stakeholders assisting them in sharing their domain knowledge for all phases of BPM.

A business process model can be depicted using a number of different process modelling languages, each with their own advantages and disadvantages (White and Miers 2008). In this study we use Business Process Modelling Notation (BPMN). BPMN provides a visual representation of the order of activities taking place within business processes together with the types of people who normally do these activities. Another important category is the information required for these activities, especially because the expected outcome of BPM is an IT-based change process

Construction Process Models with OSM Intervention Points

Stage One of this study developed a simplistic generic construction project process model encapsulating the research scope. This draft process model was informed by a review of construction industry professional knowledge-based literatures. The draft model provided a high-level overview of a generic construction project enabling researchers to identify key activities, resources and information linked to defined project phases. A second level of complexity was captured in draft models of six

phases. These were refined using the domain knowledge of the research team (Mechanical Engineering, Project Management, Quantity Surveying, and Building). For more information concerning the construction projects phases see Kenley et al. (2012). For clarity, only a section of one phase base-line model is shown in figure 1 as an example of process model development for this research.

Figure 1: Section of Base-Line Process Model, Arrange Team (Multiple Viewpoints)

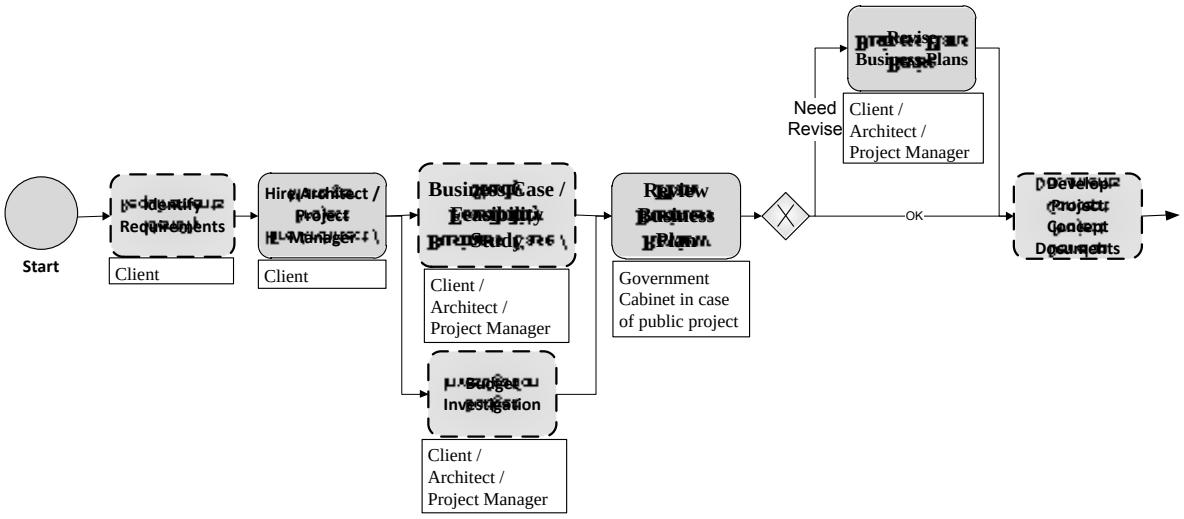


Figure 1 is an example a BPMN generated process model. It provides a picture of activities (in the grey box) relating to specific stakeholders such as the client or architect (in the white box) involved in arranging a construction project team. The addition of government as a stakeholder is because in Australia most the infrastructure projects are government initiated. This model illustrates high-level processes related to different categories of activities: resources, such as Budget Investigation or information, such as Review Business Plan. The sequencing is indicated by the arrows. The possible OSM intervention points identified in the literature are indicated with the dashed-line grey activity box.

Complex models of all phases of a generic construction project, developed as base-line process models, became the framework used to obtain construction industry stakeholder domain knowledge for reuse (Kanjanabootra 2011). This report describes domain knowledge reuse collection and application in the base-line process model section of Arrange Team phase shown in figure 1.

DOMAIN KNOWLEDGE REUSE

The definition domain knowledge reuse is when personal knowledge of how to do a task (a process) is used to do a similar task in another context (Kanjanabootra 2011). *Stage Two* of the research attempted to capture the domain knowledge for re-use within the context of OSM adoption interventions. Interviews with construction industry professionals resulted in model modification related to usability (based on expert domain knowledge). Modifications requested during stakeholder interviews were incorporated in the base-line model used in the next interview, forming eight generative iterations (Vitharana 2012). In this way changes were also verified as

usable for multiple domain knowledge areas. This open-ended qualitative approach (Holliday 2007), involved an opportunistic sample of 16 experts (see table 1).

Table 1: Domain Experts and their Expertise for Knowledge Re-use

Domain Experts	Number =16	Type of Organisation
Architect	2	Australian-based International Architectural Organisation
CEO	1	Australian-based Consultant for BIM and Precision Instruments
Government Client	4	Government Buildings and Works (Finance)
Project Manager	5	Australian-based International Infrastructure Contractors
Site Manager	3	Australian-based International Infrastructure Contractors
Service Supervisor	1	Australian-based International Asset Management

The base-line model in figure 1 was firstly used to verify possible OSM intervention points (the boxes with the dashed borders). The first column of Table 2 indicates the experts' answers to the question "Where in the process illustrated by this base-line model has OSM implications?" The second column shows suggested process modification to the base-line model activities (see Figure 2) related to re-use of personal knowledge by the domain experts interviewed.

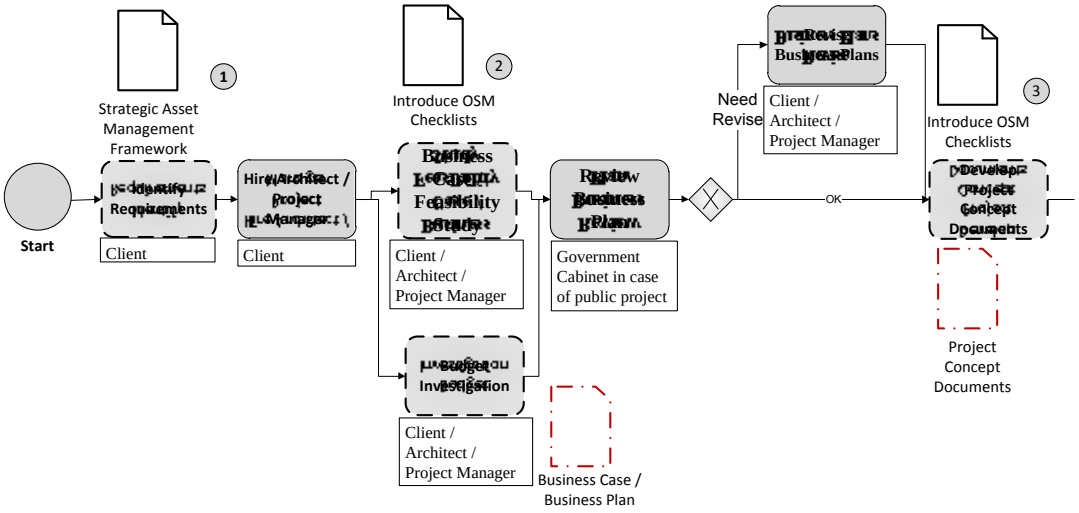
Table 2: Changing the Process by Adding an OSM Adoption Intervention

Domain Knowledge Re-use Interview Data	OSM Intervention (number in Figure 2)
"It is often the OSM concept has not been initiated during the "Identify Requirements" and the project has been carried away into the design phase and the project is trapped in the non-OSM concept which is difficult to change."	**1** Additional Process: Organisational Strategic Asset Management Framework review has been added to the task of developing the project requirements to ensure that the option of OSM is included as per the SAMF.
"There is a lack of OSM option analysis guidelines to help governments make decisions during the 'Business Case/ Feasibility Study', as a result the project team cannot see overall benefits of adopting OSM."	**2** Additional Process: OSM checklists to assist project teams evaluate OSM adoption in order to make a business case.
"Ideally, it would be useful if we have some input or comments regarding to production process and transportation aspects from suppliers/contractors during 'Develop Concept Documents'.	**3** Additional Process: OSM checklist to assist with project logistics for OSM options along the supply chain.

Based on the outcomes of the interviews, base-line construction processes modelled in BPMN for *Stage One* of the research were modified. Figure 2 illustrates the first section of the modified process model. The first activity Identify Requirements has been verified as an activity as OSM intervention point (depicted using dash-line) which is carried out by a client. Number 1 (in the grey circle) indicates the addition activity suggested through the reuse of domain knowledge: the sheet of paper is the BPMN notation for information linked to an activity, in this case the Strategic Asset Management Framework. Number 2 (in the grey circle) the 'Business Case/Feasibility Study' and 'Budget Investigation' activities undertaken by various people were also verified as opportunities for OSM adoption. Domain knowledge

reuse in the form of decision-making checklists have been added to the process model. Number 3 (in the grey circle) is linked to additional information needed, in the form of a checklist, at the 'Develop Project Concept Documents' activity.

Figure 2: Example of Domain Knowledge Reuse Modification of Base-Line Model



Industry expert understanding the purpose of a construction project process of Arrange Team has provided innovations to that process. Figure 2 shows the modified process which is facilitated the re-use of their personal domain knowledge at each OSM intervention point. As with all innovation, the new process is expected to be a more effective way of doing the same activity (Kanjanabootra 2011). In this instance the activity of arranging the projects team will have more information about OSM adoption at an earlier stage in the construction project process.

CONCLUSIONS AND FUTURE RESEARCH

This report describes research into how to provide OSM adoption frameworks through business process base-line models. This paper has been able to provide only three examples of OSM intervention points being created through domain knowledge re-use in the base-line model. However, it is clear that even these small process interventions have the possibility of a large effect. The reuse of individual domain knowledge for innovation is evident because the industry experts interviewed for this research requested specific modifications to the identified construction project process models. The effect of sharing this re-used domain knowledge to support OSM adoption means that other industry stakeholders will now be able to be able to consider OSM adoption earlier in the construction process. The modified processes are expected to increase stakeholder confidence in perceiving opportunities for productivity gains through OSM adoption.

Stage Three of this research will be the creation of an IT-based prototype of the processes that have been integrated in the Baseline Models throughout *Stage One* and *Stage Two*. The pilot application using process/workflow technology will be able to provide automated support for selected tasks. Thus, a demonstration of how an IT-based tool that can provide automated support for adoption of OSM. It is expected the tool will facilitate knowledge sharing among industry stakeholders. For example

the tool could be used together with documents including embedded OSM checklists for specific projects to expedite changing project processes. The tool will also have the ability to integrate with other technologies within the construction industry such as BIM systems thus becoming a champion for change: increasing OSM adoption.

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Health and Safety - Teaching the Law and Educating for Prevention

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Abstract:
The teaching of law to non-lawyers can involve an unreceptive audience, particularly when the subject is health and safety. The author works with prospective rural practice chartered surveyors who are likely to be professionally involved with the two highest risk working environments in the UK : construction[1] and agriculture.[2] Unlike construction, the agricultural industry has failed to reduce annual fatalities in the past quarter of a century and continues to account for around 20% of workplace deaths, whilst employing under 2% of the workforce.[3] This paper explores the use of court cases, as an introduction to studies, to pique student interest, enhance legal skills and, importantly, to attempt to influence life-long behaviour for those with future responsibilities in these areas. Students are also exposed to the field work of the Health and Safety Executive. The paper sets out some of the issues and experiences of teaching health and safety law to non-law students, outlines the cases used (for the 2011/12 cohort) and reviews the responses to preliminary research ascertaining student attitudes and understanding of the area before and after teaching.

Keywords:
health and safety, law teaching, surveyors.

1 Introduction - home institution, courses and study

This paper is based on the author's teaching experience on law modules to students of the RICS[4] accredited rural land / estate management undergraduate and post-graduate 0rural Shropshire, between Birmingham and the Welsh border and was, until 1995, known as an Agricultural College. It was founded in 1901 on the legacy left by Thomas Harper Adams in 1892 (Williams, 2000). The College has a working mixed[5] farm of nearly 1,000 acres together with 175 acres of woodland. The

[1] www.hse.gov.uk/statistics/industry/construction/index.htm
[2] www.hse.gov.uk/statistics/industry/agriculture/index.htm
[3] Labour Market Statistics 2011, Office for National Statistics. www.ons.gov.uk/ons/rel/lms/labour-market-statistics/september-2011/statistical-bulletin.html#tab-For-May-to-July-2011- and *Agriculture in the United Kingdom* 2011, Department for Environment, Food and Rural Affairs, www.defra.gov.uk/statistics/files/defra-stats-foodfarm-crosscutting-auk-auk2011-110530.pdf (viewed 1st June 2012).
[4] Royal Institution of Chartered Surveyors.
[5] Dairy, beef, sheep, pigs, poultry and arable.

agricultural roots of the college are apparent from the notice outside rooms urging students to remove their wellies before entering!

It is worthy of note, that the degree course in question has a vocational focus and the vast majority of students (normally well over 90%) go into course relevant graduate jobs each year, i.e. as trainee chartered surveyors in rural practice, with the most of the remaining students going into agricultural consultancy, non-rural surveying, farming and just one or two a year going into completely unrelated jobs.

The objective of this study is to reflect on the issues raised by teaching law to non-law students, particularly in the key area of health and safety law, using evidence of student attitudes, understanding and achievement to inform the development of effective pedagogic materials and techniques.

2 The imperative of understanding health and safety law and practice

Health and safety is a subject which should be covered at various points in a land based curriculum, most certainly not just becoming a 'tick box' exercise, a symptom of poor practice in the sphere of health and safety which is all too prevalent[6]. In the undergraduate course it is currently introduced in the first year as one lecture in an introductory law module, supported by a tutorial session and on-line quiz, in the second year in a number of pre-placement briefings and exercises (all students do a mandatory sandwich year) and in the final year in a professional practice module. It is also addressed in a range of practical situations in modules involving, for example, construction, agricultural machinery, livestock and site visits to farms, woodlands and estates.

As an adjunct to the in-house delivery, the Health and Safety Executive, Agriculture Sector, work closely with the institution and give an annual talk and video showing pictures of shocking injuries and even fatalities and some harrowing footage of close relatives of victims discussing the personal and practical cost of serious injury and death, often in the context of a family business. These materials are not replicable and are an invaluable aid to embedding the message of safe working practices and management.

The subject is particularly relevant in the sector involved as in agriculture and related industries (such as forestry) there were 42 fatal injuries in 2010/11 with a corresponding rate of 8.0 deaths per 100 000 workers, compared to an overall rate across all workers of 0.6 per 100,000. In construction there were 50 fatal injuries, with a rate of 2.4 deaths per 100 000 workers (Health and Safety Executive, 2011). Comparing the figures of 1987/88 where the rate of deaths per 100,000 was 10.2 in agriculture and 10.7 in construction, although there is improvement, clearly in over 20 years agriculture and the land based sector has not made the strides of other hazardous occupations. This picture is replicated in other western countries.[7]

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[6] *Uren v Corporate Leisure* and *Ministry of Defence* [2011] EWCA Civ 66. [2011] ICR D11, [2011] All ER (D) 49 (Feb)

[7] For the USA see National Institute for Occupational Safety and Health, Center for Disease Control and Prevention, Agricultural Safety - http://www.cdc.gov/niosh/topics/aginjury/; for Canada see Canadian Centre

An understanding of the need for and content of health and safety teaching has evolved with reference to various sources. Several members of staff are practicing rural chartered surveyors, examiners for the RICS and other relevant bodies such as the CAAV (Central Association of Agricultural Valuers) and the ICF (Institute of Chartered Foresters) and are thus well placed to know what students require in their future working lives, as is vital on vocational courses. Regular liaison, in course development, with practitioners highlights health and safety as being of major importance and a level of competence is mandatory in qualifying as a chartered surveyor (RICS, July 2006). The number of workplace fatalities and serious injuries in the past year in rural practice,[8] with (from industry discussion) an increasing concern in livestock markets, has highlighted the need for an understanding of the legal framework and compliance, for legal and financial reasons and, of course, to protect the health, safety, welfare and possibly, life, of employees and others. As well as the importance of understanding the issues as individual workers, the students will often have responsibility for other staff, premises and contractors at an early stage in their careers.

In developing effective teaching methods and materials, the long term goal is to try impact behaviour (Gielen and Sleet, 2003) in the land based sector. Whether the most effective means of imparting the health and safety message is through ever more straightening legislation and sentencing (Zimring and Hawkins, 1971; Hawkins, 2002), through general industry publicity such as the press (Ozegovic and Voaklander, 2011), through behaviour-based management (Stranks, 2009) or through formal, classroom education (Germeni *et al.*, 2009 and 2010) such as is under consideration in this paper, is a matter for further research.

This, then, directs thinking very clearly to the *purpose* of teaching non-law students - not to get students to 'think like a lawyer' (Mertz, 2007), but rather to impart practical information directly relevant to their working lives (Morris, 2010). The health and safety curriculum clearly illustrates the interaction of primary law - the legislative framework and a body of cases - with reference of how to comply with that law in terms of practical workplace behaviour, from carrying out risk assessments to the practical matters such as lone workers leaving contact details, location and expected time of return, not carrying out certain animal handling operations unaided, leaving tractors in a safe position, and so forth - good practice as well as an understanding of legal liability.

This emphasis on skills (Cox, 1992) and context (Saunders and Clarke, 1997) rather than purely 'knowledge' (Harris, 1992) is, of course, a feature of the law, as well as non-law, curriculum, discussed for decades and encouraged nearly a quarter of a century ago by the Marre Committee Report (1988). It enables a greater interaction between law and non-law pedagogic literature and lecturers with an inter-disciplinary relevance that was, perhaps, not always the case. The need for context is, then, embedded in course objectives (Woodcock, 1989) with the imperative of carefully considering how the law will impact the working life envisaged by most of the students (Endeshaw, 2002).

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for Health and Safety in Agriculture - http://www.cchsa-ccssma.usask.ca/aboutus/index.php ; for Australia see Australian Centre for Agricultural Health and Safety - http://www.aghealth.org.au/ (viewed 21st May 2012).

[8] The unconfirmed figures from the Agriculture Sector of the Health and Safety Executive for 2011/12 are 50 agricultural (and related) industry deaths.

Having established that health and safety law needs to be taught for substantive content, to comply with professional and practical needs and, of course, to develop transferable skills beyond the acquisition of core knowledge - what problems have been encountered in attempting to cover this area with non-law students?

3 Teaching Law to Non-Lawyers

When teaching law, that there is a difference in learning styles and receptiveness between law students and non-law students has long been acknowledged by researchers (Twining, 1967 and Richard, *et al.* 2009). The teaching of law to non-lawyers can involve an unreceptive audience, particularly when the subject is health and safety, based on student perceptions of relevance (Dobson and Marsh, 2008), accessibility and pedagogic issues surrounding delivery.

As prospective rural practice chartered surveyors the students can find 'black letter' law dry and demanding (see Hutchinson, 2005, for a useful comparative discussion of the legal content of construction and surveying courses across seven institutions). This paper explores the use of court cases to engage student interest, enhance legal skills and underpin wider legal studies and, importantly, to influence behaviour for those with future responsibilities in these areas. The paper also includes responses to preliminary research ascertaining student understanding of the area before and after teaching.

3.1 Academic Range

The course in question involves a wide academic range of students due to the specific professional focus of the course and the limited number of institutions offering a rural practice specialism.[9] For most UK university courses it would be unusual to have a course with an entry requirement of 280 UCAS points (in 2011/12) to have applicants with three, or even four A grade A2s. Students also come in with 'A level equivalent' qualifications such as BTEC National Diplomas in vocational subjects such as Agriculture or Countryside Management. This academic diversity makes the careful consideration of teaching methods particularly important (Davis, 2003), to help ensure the inclusion of those coming in with lower previous academic achievements, whilst maintaining the interest and fully challenging and developing the most able.

3.2 Relevance?

Pleasingly, (mercifully!) some students clearly understand the relevance of health and safety law, particularly as they will be undertaking a working sandwich year (all Harper Adams undergraduate degree programmes include a mandatory placement year, which for most students includes APC[10] registration) which ensures that formal employment is a key feature of the course culture from the outset. Many students also have extensive agricultural work experience or experience in other potentially hazardous environments such as livestock markets or in property businesses.

[9] The Universities of Cambridge, Reading and Aberdeen offer closely related courses but only the Royal Agricultural College at Cirencester has a direct equivalent.

[10] Assessment of Professional Competence - the work based element required for RICS qualification as a chartered surveyor.

However, although, as lawyers we might live and breathe Lord Wright's : 'Law in its own way covers the whole range of human activity …' (Gower, 1950) others, who have not really considered what their chosen profession actually involves, do not always arrive at university ready to embrace legal studies (Allen, 2007).

Effective teaching requires that students understand the relevance of their studies and that their engagement is maintained and the effective lecturer will constantly evaluate, both formally and informally, whether this is occurring and adjust delivery and materials accordingly (Ramsden, 1992 and Corbin, 2002). In developing an understanding of relevance, and best engendering learning, utilising students' existing knowledge of practical situations and relating the operative law to that setting through case studies has been found to be effective (Oppenheimer, 1999).

3.3 Demanding?

As the teaching of health and safety matters is underpinned by an overview of the key primary and secondary legislation (this being, of course, a densely regulated subject) the nature of the material and the unfamiliar terminology can make the subject forbidding for some who can be, as expressed by Allen in her considerable work on teaching law to business students, 'alienated' by the discipline (Allen, 2007). This is not the place to explore perceived standards of British secondary education - the students arrive at the start of the first year as a product of their preceding education (Datta and McDonald-Ross, 2002), but it is clear that the written language of law can be unfamiliar (Vick, 2004), inaccessible (Christudason, 2004) and generally overwhelming (Allen, 2007) to some, even those whose entry qualifications mark them out as more 'able'.

In a vocational, non-law course, students perceived demands of legal studies are often exacerbated by comparison with other modules, such as Forestry. There has been a consensus, following discussions in Course and Examination Boards, that all modules on a course need not be of precisely equal demands if, indeed, such an exact science were possible.

So the challenge is to present materials which are demanding enough to be accurate, to stretch ability and to develop higher level cognitive processes (Bloom, 1956), whilst being accessible (McGeveran, 2007).

3.4 The *Law* Lecturer

A final and, obviously, crucial feature that can impact the success or otherwise in the teaching of law to non-lawyers (or any teaching, for that matter) is, of course, the lecturer. Those who read law may be immersed in 'black letter' content and the traditional domination of the study of primary sources (Soetendorp and Byles, 2000) probably through the medium of lectures, tutorials with a heavy pre-reading load and assessment through essays.

That a concentration on legislation and precedent, with little reference to context and the wider world, is limiting has been recognised well over a century (Holmes, 1897). It is, then, most certainly apparent that the 'law school' approach is inappropriate to courses where, in particular, (a) the students will not / cannot / are unlikely to engage in a high volume of reading, (b) where a wide range of topics have to be covered in

limited detail, and (c) where the nature of the subject has, as with health and safety, a very practical aspect.[11]

This concern of a black letter approach for non-law students was usefully explored by David Doorey in the context of Canadian employment law courses. Drawing on Twining's exposition of developing separate theories of legal education for lawyers and non-lawyers (Twining, 1967), he particularly highlighted the need to ask *why* a particular course is being taught and what students want and need from a course rather than taking the same approach as with law students (Doorey, 2007).

Morris (2007) suggests that the goal in teaching law to land and property students is both to be able to work intelligently with lawyers, *and* the goal of keeping themselves out of trouble through the practice of 'preventative law' (Ridley, 1994). We are, for reasons of practicality and accessibility, into the realms of 'translating' the law rather than having students make extensive use of primary sources. The materials are reduced to a core. Although there are dangers in this (Ward and Slater, 1990) there is a considerable need (regardless of an academic ideal), in many of the legal subject areas, to get across a level of 'prophylactic law' - a base level of knowledge to avoid dangerous or expensive mistakes in professional life (Soetendorp, 1999 and Soetendorp and Byles, 2000) and with health and safety this can literally mean the difference between life and death.

These, then, are some of the issues which the teacher of law on a non-law course needs to address. Subject benchmarking statements, professional guidance and the experience of colleagues have been drawn on to determine the mix of substantive knowledge and the transferable (NCIHE, 1997) research and evaluation skills needed which also seek to support ' … diversity, flexibility and learner autonomy' (Hinett, 2002). Also, whilst not teaching future lawyers, there are key points to be transferred across the disciplines, such as :

- where to find the law
- that the law is constantly changing (Soetendrop, 1999)
- the ability to identify legal issues (Cownie, 2004)
- getting beyond the surface learning of facts, through to a deeper understanding (Marton and Säljön1976 and Meyer and Land, 2005).

Vocational law courses / modules which have often avoided the final issue and have provided a diluted delivery of facts, without the contextual framework offered to law students (Broadbent, 2005), which does little to develop understanding and proliferates the idea that law can be a dry set of unambiguous rules.

4 Methodology

In considering, through personal experience, colleague input and data, the short comings of current teaching, analysing and reflecting on the position and developing changes, the evolution of teaching methods and materials is broadly following an iterative process of change under action research methodology, first explored by the Prussian American psychologist Kurt Lewin (1946) and later developed in an educational

[11] A defence or rejection of black letter teaching for *law* students is left for others to consider.

context by many, notably the highly politicised Brazilian left wing educator Paulo Freire (1971) who particularly developed student centred education from its inception with Jean-Jacques Rousseau (1762), the prolific Swiss philosopher. It can be quantified as a form of systematic enquiry resulting in a direct impact on an educator's practice (see also Glanz, 2003).

A methodology on data collection is not provided due to the early stage in the formal analysis of results, which will require more detailed testing to assess beyond the, none the less valuable, impressions which have been garnered.

5 Teaching Practice

The remainder of this paper relates to the attempts to improve the engagement of students and the effectiveness of module delivery. In addition to the self evaluation of the author and peer review, a pilot study of student perception and understanding was carried out. As health and safety law is a relatively small part of any module, there is limited formal examination.

5.1 Lectures

That lectures are not the perfect mechanism to disseminate information and for the effective assimilation of that information is not a new assertion (Gibbs and Habeshaw, 1996), and much has been written on ways to enhance their value and effectiveness (Jenkins,1992; Gibbs *et al*., 1992; Fry *et al*., 2003 and, particularly enjoyably, Bligh, 1998) in terms of engaging interest, maintaining concentration and imparting knowledge, or signposts to acquiring knowledge and skills (Cain, 2007). And an over-emphasis on the regulatory nature of health and safety law can do little to ameliorate some of the most notorious shortcomings of the lecture model. Although keen, then, to develop effective ways of engaging and educating non-law students, the dissemination, or at least introduction, of a base of information is still most effectively done through the lecture and although direct reference to primary sources does not hold a central position (Carrington *et al*., 1995) for the education of non-lawyers, an explanation of the existence, mechanisms, facts and points of law comprising these primary sources of law still underpins the curriculum.

5.2 Notes

In addition to copies of the lecture Powerpoint, a 130 page book has been produced, with short outlines of around 150 cases - *Health and Safety Casebook : key cases from 1837 to 2012 with particular reference to the land-based industries* (de Silva, 2012).

Although these notes do not obviate the requirement that students refer to text books and, on a more practical level, the Health and Safety Executive website,[12] there is a limited requirement for them to refer directly to primary sources in this element of their studies.

[12] www.hse.gov.uk.

5.3 Case based teaching of health and safety to non-lawyers

To try to address the problems encountered in teaching health and safety law to non-law students in a largely lecture based environment - 'fear' of law, disengagement with the phrase 'health and safety' and the like - cases have been introduced as a starting point to learning, in contrast with an earlier approach where the basic legal provisions were disseminated through lectures. Whilst not going into the detail of the casebook method of law teaching common in American law schools,[13] the aim is for the student to appreciate the *relevance* of their legal studies, and to enable the lecturer to move away from too formulaic an approach of talking through the legislative framework, much of which can be provided in note form and with links to further reading. It is hoped that this helps to make materials more accessible, and gives purpose and focus to private study (Monseau, 2005). Morris (2007) considered that students responded to case studies 'perhaps for [their] vivid exemplary or story content.'. This also clearly keeps in mind the key issue of what the *purpose* of the teaching is and what one is trying to achieve (Jacobson, 2011).

Case studies have more usually been introduced after a body of law has been set out in a lecture, addressing none of the problem issues raised above and resulting in students failing to engage before they ever get to assimilate the information and attempt to reach the higher level educational objectives of analysis, synthesis and evaluation (Bloom, 1956 and Anderson and Krathwohl, 2001) to apply their knowledge. Of course, basing studies exclusively on cases could leave gaps of coverage and, indeed, balance (Cownie, 2002) but they have proved a useful base for establishing the importance of teaching about health and safety law and providing a practical meaning (Chan *et al.*, 2002).

Several scenarios from law reports are given to read before coming to the lecture. A range of questions relating to the case studies are also given, to raise questions and to prompt independent study. The applicable *law* is not, however, given ahead. The cases are reviewed in the lecture with a review of the law at that stage. This has helped students understand how the law applies to a very practical situation or incident.

6 The Cases

Cases which have been used this year include the following. The reasons for choice are indicated.

Armstrong, Douglas John - Inquiry into the circumstances of the death of, under the Fatal Accidents and Sudden Deaths Inquiry (Scotland) Act 1976[14] Sheriff Court

This involved a fatality after a quad bike accident on a rural Scottish estate. An overloaded bike was being used by a casual, untrained worker to do the pheasant feeding rounds. He arranged to cover for a sick friend. No risk assessment resulted in a lack of means of communication, no check on competence to ride a particularly

[13] See Kaufman, 1998.
[14] Selkirk Sheriff Court, 28th August 2008

powerful quad bike, no helmet, no lone working policy, no route map. The deceased was not found for two days. The matter resulted in a conviction of the Trust who held the estate under the Health and Safety at Work, etc. Act 1974. There was an action against trustees personally which was later dropped but which added legal interest in terms of business structure and the personal responsibility of office holders.

British Railways Board v Herrington **[1972]**[15] House of Lords

This well known case involving a child being seriously injured when trespassing on British Rail land resulting in a successful occupiers' liability action was chosen to indicate that the responsibility of employers may result in civil action. It also stresses the need for awareness of members of the public who might be on the premises, and ties in to other studies on occupiers' liability and the development of law in that area with the resultant introduction of legislation.

R v Morris, Marshall & Poole **[2011]**[16] Crown Court

This case resulted in a conviction of a company under the Health and Safety at Work, etc. Act 1974 following the death of a 79 year old freelance 'odd job' man. He fell from a roof whilst carrying out property repairs and maintenance for a letting agent. There was little evidence of a risk assessment. This case discussed risk assessments and highlighted the level of responsibility towards workers who are *not* employees.

R v Velcourt **[2011]**[17] Crown Court

A 21 year old harvest worker died when the extended grain spout of his combine harvester contacted an 11,000 volts overhead power line. He was working with one of the biggest, tallest machines on his first commercial harvest. Velcourt Ltd were found to have failed to adequately inspect, monitor, supervise or audit health and safety management at the farm or to ensure that the farm manager received adequate health and safety training.

The case shows the importance of risk assessment and adequate training.

R v British Sugar plc **[2005]**[18] Crown Court

British Sugar plc and transport contractor, VM Plant Ltd, were convicted after an office worker was run over by a shovelling vehicle at the firm's factory in Suffolk. British Sugar admitted failing to ensure that workers were not exposed to risks to their safety. In particular, it failed to adequately segregate pedestrians from areas where vehicles were in operation

Despite a good health and safety record before the accident, within a month another employee had been killed in a boiler room explosion. This prompted a major health and

15 [1972] AC 877, [1972] 1 All ER 749
16 Mold Crown Court, sitting in Chester Crown Court, 20th December 2011, ref. T20110335
17 Salisbury Crown Court, 17th May 2011
18 Bury St Edmund's Crown Court, 8th February 2005

safety review where British Sugar found a gap between training and ensuring that processes were actually being followed, and also a reliable and efficient method of data gathering with regard to reported incidents such that management could regularly review and pick up areas for concern.

The case highlights the point that it is not just those operating hazardous machinery or working with livestock, etc. who are at risk.

R v JMW Farms Limited **[2012]**[19] Crown Court

Only the second conviction for corporate manslaughter under the 2007 Act was brought after a fatality on a pig farm in Northern Ireland. The death occurred when a feed bin was balanced on the prongs of a fork lift truck being driven by one of the company's directors. The bin was not fitted for the truck in question and it fell, crushing a 45 year old farm worker. This case gives a contextual backdrop to an introduction to the Corporate Manslaughter and Corporate Homicide Act 2007 and was heard just in time for the final 2011/12 teaching session and will be explored in more detail in future years.

Uren v Corporate Leisure **and** ***Ministry of Defence*** **[2011]**[20] Court of Appeal

Uren involved a young serviceman rendered paralysed after diving into a paddling pool head first whilst playing organised games on a 'fun day'. The case is useful, in particular, for Smith LJ's consideration of risk assessments and for the position where an employer sub-contracts an activity to another. The Ministry of Defence were the employer, Corporate Leisure were an events organiser running the 'fun day'. The trial judge's decision that, although proper risk assessments were not carried, the risk was small when balanced against the social benefits of the day was rejected and the case was remitted for re-trial.

Walker v Northumberland County Council **[1995]**[21] High Court, QBD

This case, involving a social service manager, is important as being the first to establish that an employer can be held liable for psychological injury to an employee caused by work related stress. The judgment underlined the employer's duty of care to provide safe systems of work in respect of occupational stress as well as other hazards, and to take steps to protect employees from foreseeable risks to their mental, as well as physical, health.

Whitehead v Trustees of the Chatsworth Settlement **[2012]**[22] Court of Appeal

A gamekeeper shot himself in the leg when he slipped whilst carrying a loaded (although broken) gun. The employer was held to be *not* liable - they could clearly evidence that instruction and information on good practice (i.e. not having the gun loaded and ready to shoot) had been provided, with regular review and staff reminders.

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19 Laganside Crown Court, Belfast, 8th May 2012
20 [2011] EWCA Civ 66. [2011] ICR D11, [2011] All ER (D) 49 (Feb)
21 [1995] 1 All ER 737, [1995] ICR 702, [1995] IRLR 35, [1995] ELR 231, [1994] NLJR 1659
22 [2012] EWCA Civ 263

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7 Has it made a difference?

This style of teaching has been taking place for two years, 2011 and 2012, following many years delivering the outline health and safety provisions in a rather more pedestrian style. It is intended to build in formal testing of this element whereas currently the summative testing is relatively limited due to health and safety comprising a relatively small part of an overall module, or non-examinable briefing. At this stage, however, although that detailed testing has not taken place, three means of assessing effectiveness have been used. Firstly, anecdotal review by the lecturer, comparing student interest in class and engagement with pre-reading. Secondly, peer review of a lecture by a colleague, particularly assessing student engagement by the volume and questions and answers from the student group. And thirdly, a small study of student feedback on their attitudes to and understanding of the health and safety element of the module (rather than just overall module feedback) has been sought this year, with input both before and after the relevant lectures and tutorials.

Self and colleague evaluation is such that, in comparison with other law lectures, the number of students completing the pre-reading and consideration of the cases, as judged by participation and questioning in class, is higher than usual. Student interest is clearly sparked by the combination of (a) the fact that they are looking at 'real' court cases and (b) scenarios with which many of them are familiar.

Before the case-based health and safety lecture and tutorials, questionnaires asked for a statement of students' practical experience, level of health and safety training and views on the importance of health and safety training. Before the sessions over 50% of students indicated that they thought that a knowledge of health and safety practice was important but not health and safety law. After delivery they were asked about learning and any changes in perception. Feedback from these surveys unsurprisingly indicates enhanced perception of the need to understand the law and to take health and safety seriously. It was surprising, however, how many indicated, on paper at least, that *before* the sessions they were fully aware of the importance of this area. There is no formal data from previous years but the author and other staff are clearly cognisant of the lack of interest and dismissal of the subject in former years. This has coincided with increased publicity in the agricultural and rural practice sector of the concerns.

Quantitative data will be collated for a follow up paper on results of tests in health and safety law.

8 Conclusion

The case studies show how the use of real situations can trigger an appreciation of relevance and pique interest to explore the underpinning law, forming a basis on which to develop more technical studies.

The teaching of health and safety law to an academically diverse range of students whose abiding interests might lie well outside legal studies requires careful consideration, a willingness to try a range of teaching and assessment ideas and the grace to alter and abandon methods which fail to engage or prove effective.

It is hoped that the exploration of a case led programme has enhanced the delivery of health and safety information at Harper Adams and may provide some ideas for others.

9 Acknowledgements

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Online Pedagogy for Construction Law in UK Higher Education

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Abstract:
The UK higher education sector is contemplating the opportunity of online learning. The challenges include delivering quality and cost-effectiveness while meeting student demands for flexible learning.The author critically reviews key UK higher education online learning reports and online pedagogy literature and applies them to a first year undergraduate Construction Law module currently taught on campus using a mixture of lectures and tutorials. The module aims to develop understanding of the English legal system, law of contract and to introduce key procurement approaches, tendering procedures and forms of contract applicable to building projects.The author has the additional insight gained by completing a "Learning How to be an Online Tutor" in-house course which was taught entirely online. A University Online and Distance Learning Project Director was interviewed about the University's strategy and plans for online and distance learning. The current module students who are studying for an HNC in Building Studies were surveyed both in class and online about their learning experiences and possible online study. The author outlines the implications for the design of online learning including asumptions, virtual learning environment, online academic material, synchronous meetings and non-academic support. The paper concludes by considering online learning from student, academic and university perspectives.

Keywords:
construction law, online pedagogy , UK higher education

1 Introduction

The UK higher education sector is seeking to expand its online learning provision. This is driven by universities' aspiration to increase their reach beyond students in their immediate geographical area and students' needs for more flexible learning. The UK higher education online learning reports reviewed indicate that the sector has so far only made limited progress.

The author was tasked with designing an online version of a first year undergraduate Construction Law module. The module forms part of the HNC Building Studies course which aims to develop students with a technical understanding of the construction industry.

The course is delivered only on a part time basis over two years. As such students have the opportunity to attend this course through day release from their relevant day to day employment. The planned delivery of the Construction Law module online is to give the students more study flexibility.

The review of online pedagogy literature analyses and summarises why online pedagogy is different, widening participation, online tutor training, virtual communication tools and their role, virtual learning environments and collaboration and online support.

As the University of Wolverhampton is expanding its online provision, it has appointed an Online and Distance Learning Project Director. As part of this research he was interviewed about the University's strategy and plans for online and distance learning.

The 21 current Construction Law module students who are studying face to face on campus for a HNC in Building Studies were surveyed both in class and online about their learning experiences and possible online study.

The author outlines the implications for the design of online learning including asumptions, virtual learning environment, online academic material, synchronous meetings and non-academic support.

The papers concludes by considering online learning from student, academic and university perspectives. It also looks to the future of higher education online provison.

2 Online learning for UK higher education

2.1 Review of key reports

To place online learning for UK higher education in context, the following key reports since 2008 are reviewed in chronological order:

- *"On-line Innovation in Higher Education"* by Professor Sir Ron Cooke, Chair of JISC Board Submission to the Secretary of State for Innovation, Universities and Skills dated 2008
- *"Study of UK Online Learning"*: Report to HEFCE dated 2010
- *"Collaborate to compete. Seizing the opportunity of online learning for UK higher education"*: Report to HEFCE dated 2011

The re-occurring themes are then analysed.

2.2 *"On-line Innovation in Higher Education"*: Submission to the Secretary of State for Innovation, Universities and Skills dated 2008

Professor Sir Ron Cooke was Chairman of JISC, the UK's expert on information and digital technologies for education and research.

In his submission, Cooke (2008, p.3) set out the challenge that *"the UK should, and can, be world leading in on-line learning".* He lamented (p.10) that

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> *"In particular the UK is not doing enough to provide a more or less complete on-line educational experience to students who, for a variety of reasons (economic, lack of time, geography) cannot enjoy a conventional campus based learning experience. This is especially true of students where demand for higher education outstrips supply such as the emerging economies of South East Asia and South America and those developing countries that are likely to become increasingly important over the next 15 years. Here the UK is currently doing very little under the excuse of having tried it once (the UK e-University) and failed."*

There is however an example of success although it is not in the UK. The Open University of Catalonia opened in 1994 as the first entirely online-based university. It has since grown to more than 46,000 students. Bradwell (2009).

Professor Cooke's recommendations included that the UK must have a core of open access learning resources organised in a coherent way to support on-line learning by all higher education institutions.

2.3 "Study of UK Online Learning": Report to HEFCE dated 2010

White et al. (2010) were commissioned by HEFCE in order to gain a broad overview of the current UK provision of higher education (HE) level online distance learning (ODL). (The Higher Education Council for England (HEFCE) distributes public money for higher education to universities and colleges in England and ensures that this money is used to deliver the greatest benefit to students and the wider public.)

From the data collected, the study observed the following trends:

- Almost all of the ODL courses identified could be described as continuing professional development;
- the vast majority of ODL offered by HE institutions is at postgraduate level;
- Although the number of first year undergraduate courses was relatively high (approximately one third of the total), most of these were short standalone courses, typically offering 10 or 20 credits towards an HE award

The study also found that there is no reliable or accurate consolidated source of information about ODL courses offered in the UK that is readily available to students, or other parties, interested in finding ODL programmes. Much of the information on ODL currently remains "hidden" in labyrinthine institutional websites.

During interview, the study identified some common themes including (p.2):

- *"recognition of the requirement for low student-tutor ratios, and regular feedback and assessment points to ensure that students are engaged and retained;*
- *The need to address the challenge associated with "change management"; e.g. supporting the changes necessitated by the need to encourage academic staff to shift emphasis away from content dissemination towards facilitating more independent and activity-based learning;*

- *The importance of understanding the expectations of ODL students in full-time work and appreciating that their motivations, needs and aspirations may differ significantly from traditional campus-based students. The inherent advantages of ODL as a mode of delivery for students in full-time work were identified."*

A key finding was that it is student and staff support, programme development, administrative processes and business strategies that are currently seen by many as the barriers to growth of the UK OLD sector. The study also found that institutions currently seeking to expand strategically their ODL provision were looking to centralise some elements of their ODL activities, in particular student support, development of supporting resources, learning technology support, and general management and oversight of such programmes.

One of the universities interviewed advised the report's authors that staff need support in assessing whether they have considered all relevant issues including data protection and intellectual property rights.

Regarding the institutional experiences of online distance learning which drew on the university interviews and experience of the report authors the study found:

- All of the institutions interviewed pointed out that the type of high quality ODL they offered was not cheap to develop or to deliver.
- Reconfiguring academic roles (p.46), *"The most significant challenge however, in terms of institutional culture change, is not staff acquiring new technical skills but in the shift in teaching approach ODL requires. With the content transmission elements of teaching increasingly handled by online materials or pod/vodcasts, teaching online often takes a more often takes a more mentoring or facilitative role."*
- It was recognised that ODL is still evolving technologically, pedagogically and in terms of business models.
- Quality and consistency could also be improved by centralising the production of supporting materials to ensure that students and tutors are properly supported in their ODL activities. Such supporting materials include: inductions, Frequently Asked Questions, technical guides, learning support guides, teaching support guides, online etiquette tips, study and research skills. These resources are time consuming to create and require regular and laborious updating.

2.4 "Collaborate to compete. Seizing the opportunity of online learning for UK higher education": Report to HEFCE dated 2011

The Online Learning Task Force was established in mid-2009 by HEFCE and was asked to address how UK higher education (HE) might maintain and extend its position as a world leader in online learning.

The Online Learning Task Force Chair recognised in her introduction to the report (HEFCE, 2011):

- Developing and adopting appropriate pedagogy is slower than technological change. Organisational change that is needed alongside this takes even longer.
- The international market for online learning is growing rapidly although estimating its size remains a challenge.

- Similar opportunities for enhanced flexibility apply within the UK as students seek more work-based, flexible and part-time opportunities to fit work and learning opportunities into their lives.

Regarding student diversity, demand and expectations (p.10), *"Online distance learning (ODL) provides students with the flexibility to study at their own pace, in their own time and at a location convenient to them."*

In considering UK competitiveness, the report notes that

- Business lessons from unsuccessful online ventures include
  - Clarify the purpose: institutions need to know what they hope to achieve from online learning ventures
  - Understand the market and what students want: from the outset there needs to be clarity about the markets in which the venture will operate
- *"We have become more and more conscious that online learning is not a cheap option."*(p.14)

Considering strategy, processes, culture the report recognises that

- Mixed teams within institutions represent a key contribution to success. Academic and subject expertise, with learning technologists, pedagogic experts, and content specialists (e.g. librarians) working closely together is recommended.
- A major concern for students in online learning is the possible lack of personal contact with their tutors and fellow students. HE needs to enable students to learn collaboratively online with appropriate pedagogies, training and availability of technologies.
- There are many sources of quality materials, content and tools, including private sector publishers and online educational providers such as Pearson.
- Wider adoption of open educational resource approaches to online learning raises complex issues of copyright and intellectual property.

One of the case studies identified that students learning in cohorts perform better than learners following their own personalised track. This does however, constrain flexibility in the timing of course delivery.

2.5 Summary

In the reports, the following themes re-occur:

1. The UK should be world leading in on-line learning in a rapidly growing international market.
2. Despite its benefits having been identified, delivering online learning is difficult and there seems to have been limited progress in its provision.
3. The inherent advantages of online learning for students in full-time work seeking more work-based, flexible and part-time opportunities have been identified. JISC InfoNET, (2008, p.13) identified the drivers for e-learning approaches as including *"Meeting the 'new geography' of education – staff and students are physically and socially distributed and wish to pace participation*

according to personal circumstances. Flexibility in 'time and place' is essential."

4. The need to address the challenge associated with "change management"; e.g. supporting the changes necessitated by the need to encourage academic staff to shift emphasis away from content dissemination towards facilitating more independent and activity-based learning
5. Mixed teams combining academic and subject expertise with learning technologists, pedagogic experts, and content specialists (e.g. librarians) working closely together are recommended.
6. Quality and consistency could be improved by centralising the production of supporting materials.
7. Online learning is not cheap to develop or deliver. Moreover, the costs can be difficult to calculate because *"Cost models for staff time are complex; for example, most courses still use a contact model to calculate staff costs, despite the evidence that virtual 'contact' can be equally if not more beneficial to learners."* Association for Learning Technology and Technology Enhanced Learning Research Programme (2010, p.14).
8. Although recommended, the wider adoption of open educational resource approaches to online learning raises complex issues of intellectual property.

These reports prompted the author to research the University of Wolverhampton's online provision. Due to the University's expansion of its online provision, it has appointed an Online and Distance Learning Project Director. He was therefore interviewed about the University's strategy and plans for online and distance learning.

In addition, current students were asked whether they had previously studied online and if they would, in the future, choose to online study.

3 Online Pedagogy

This section reviews online pedagogy issues which are then summarised.

3.1 Online is different!

The following section explores the factors that make learning online different.

> *"The rise in popularity of distance education programmes, taught through web-based media, belies the difficulty in preparing, delivering and studying on such programmes….The technology (ICT) used to facilitate distance learning requires an increased level of learning discipline and motivation, particularly as using new technology at the same time as engaging with a new subject material can be difficult."* (Croft et al. 2010, p.27).

For example, *"students and teachers react to new educational technologies with varied emotions ranging from enthusiasm to disabling fear."* Collins (1999 cited Rovai and Hope 2004, p.2).

This prompted the author to ask students how they rated their IT competence and how often they used the internet.

Salmon (2004) and Jacques and Salmon (2007) note that most online tutors come from face-to-face teaching where they can rely on personal charisma to hold their students' interest and read their body language. Switching to online is a big challenge.

Moreover, Garrison et al (2000) also observe that traditionally, educational interactions have been based upon oral communications between and among teachers and learners. Oral communication tends to be fast-paced, spontaneous, fleeting, and less structured than text-based communication. Socially and emotionally, face-to-face oral communication is a rich medium. In contrast, written communication might be termed a lean medium, in that much of the information that creates and sustains the group dynamic of face-to-face groups is simply not transmitted.

Jacques and Salmon (2007) have identified that in asynchronous online group interaction, the written word replaces speech and visual cues leaving a record of proceedings. The audit trail does have its disadvantages as Salmon (2004, p.20) warns *"the online environment is such that interactions are rather public and recorded for all to see. Tardiness, rudeness or inconsistency in response to others tend to be forgiven less easily than in a more transient face-to-face setting."*

Newman et al. (1997 cited Garrison et al 2000) found significant differences in critical thinking between online conferences and face-to face seminars. Online conference students were less interactive but critical thinking was higher.

Sikora and Carroll (2002 cited Rovai and Hope 2004) reported that online higher education students tend to be less satisfied with totally online courses when compared to traditional courses but *"Positive comments regarding the fully online course centred on the value of reflective thinking and the extra time to process information …. The extra time to process information allowed students to give more in-depth answers and promoted critical thinking skills."* (Rovai and Hope 2004, p.9).

A study by Hopson et al. (2001 cited Salmon 2004) noted that the role of teacher was transformed *"As the students began to use the technological resources to manage their learning, the role of teacher was transformed from lecturer to guide."*

3.2 Widening participation

> *"Universities are dealing with an increasingly diverse population of students who approach university in all stages of their lives and who will require different ways of learning."* (Bradwell 2009, p.36).

JISC InfoNET (2008) recognises that e-Learning offers opportunities to support learners with a range of learning difficulties or disabilities in ways which would simply not have been possible in the past.

Online learning has the potential to reach students who might be unable to attend an institution formally. However, according to the Office for National Statistics, those with no formal qualifications are the very people least likely to have an internet connection in their home. (Bradwell 2009).

Current students were therefore asked whether they had a computer with internet broadband access to study.

In summary, JISC InfoNET (2008, p.24) argues that *"The use of e-learning has undoubtedly widened participation in UK HE, be this participation by overseas students who would not previously have been able to attend courses in the UK, by professionals who need to fit study into busy working life, or by groups of 'non-traditional' learners who form the target of government widening participation strategies."*

3.3 Online Tutor Training

The University of New South Wales (2012) website displays many interviews including case studies to help teachers to gain a working understanding of successful online teaching pedagogies.

"Feedback shows it is worthwhile for designers and e-moderators to experience courses from the participants' perspective, enabling needs to be properly anticipated and prepared for as part of the course design." (Jacques and Salmon 2007, p.205).

The author has completed a "Learning How to be an Online Tutor" in-house course which was taught entirely online.

"Currently, with a few exceptions, development of teachers, tutors, facilitators and trainers as e-moderators relies on training in the use of new technologies, typically virtual learning environments (VLEs) rather than new social communication and pedagogical skills." (Jacques and Salmon 2007, p.277).

The most significant insight gained from the course was that successfully teaching online requires different pedagogical skills. For example:

- The most successful e-moderators have some particular skills: supporting learning in text-based communication, weaving, summarising and classifying participants' messages to promote knowledge-sharing and learning and motivating and developing learning groups without physical meetings. (Jacques and Salmon 2007).
- Continual tutor presence, characterised by short messages acknowledging a student's contribution and followed by guidance, increases student activity. (Garrison et al 2000).Regular feedback is therefore to be incorporated in the online learning design.

However, *"Since faculty promotion and tenure, at present, are largely based on research and publication, some professors zealously feel that they should not take away from their research or writing time to change curricula and pedagogy, for the potential rewards are not worth the time or risk to them. Consequently, many professors still use the traditional lecture as their instructional strategy of choice."* (Rovai and Hope 2004, p.2). Although this is a United States of America perspective, the author believes that this applies in the UK too.

As a consequence, course quality can vary due to a number of factors including available technology and the capabilities of professors who design and teach the

courses. While technology has the great potential to enhance student's active learning, the use of technology requires compatible pedagogy to achieve its benefits. (Rovai and Hope 2004).

3.4 Virtual Communication Tools

As Lewis and Allen (2005) explain there are two main types of virtual communication tools and these enable different types of contacts between students and tutors:

- Asynchronous tools – enable people to communicate at a time that suits them. Examples of asynchronous tools commonly used in virtual learning communities include e-mail and bulletin boards.
- Synchronous tools – enable people to communicate live when they log onto the same system at the same time. Examples of synchronous tools commonly used by virtual learning communities include conference or chat rooms, internet telephony and video conferencing.

Dirckinck-Holmfeld (2002 cited Salmon 2004) has identified 'generations' of online learning environments as:

1. First generation: computer conferencing, asynchronous and text based.
2. Second generation: Web based, still asynchronous but now including more linked (hyper) texts and multimedia resources.
3. Third generation: includes more synchronous communication
4. Fourth generation: looking to the future including virtual reality and mobility.

The students were asked how important it would be for them to receive answers to their questions in real time for example, by a webinar or telephone conference.

The in-house online tutor course was a third generation design and author is undertaking this generation of design.

3.5 The Role of Virtual Communication Tools

Virtual communication tools undertake many different roles. For example:

- Haythornthwaite and Kazmer (2002 cited Hrastinski 2008) argue that three types of communication in particular are important for building and sustaining e-learning communities: content-related communication, planning of tasks and social support.
- Hrastinski (2008, p.2) concludes that *"synchronous e-learning increases arousal and motivation, while asynchronous e-learning increases the ability to process information…. Synchronous e-learning better supports personal participation and asynchronous e-learning better supports cognitive participation."*

Garrison et al (2000) offer a different perspective as shown in Figure 1, they suggest that a worthwhile educational experience is embedded within a Community of Enquiry that is composed of teachers and students – the key participants in the educational process.

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The model of this Community of Inquiry assumes that learning occurs within the Community through the interaction of three essential elements: cognitive presence, social presence, and teaching presence. The element in this model that is most basic to success in higher education is cognitive presence.

The students were therefore asked whether they benefitted from studying with other students. If yes, they were asked for their reasons for example, social support.

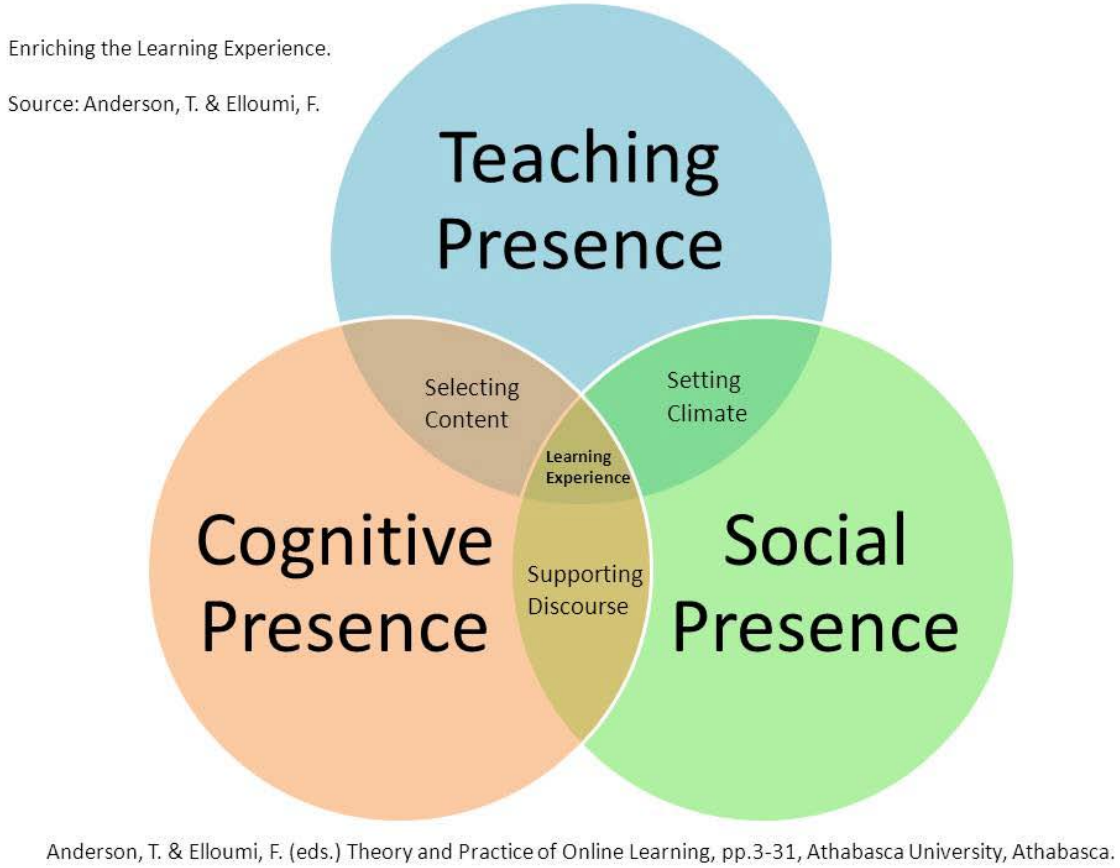

Figure 1. Enriching the Learning Experience
(Source: Anderson and Elloumi, 2010)

Croft et al. (2010) found that there was almost unanimous support for more student-student interaction from the interviewees to provide an 'online student resource where people can talk to each other'. The need to create a form of learning community, where peer contact is enabled and students are encouraged to share their work/thought, was identified as an overarching theme in the research.

The challenge for an online teacher is to consider these concepts in the design and implementation of online learning.

3.6 Virtual Learning Environments and Collaboration

University students are likely to have access to virtual communication tools and other material via a virtual learning environment (VLE) which is defined by INSPIRAL (2001 cited Lewis and Allen 2005) as *"VLEs are web-based toolkits that facilitate learning through the provision and integration of online teaching and learning materials and tools."* There are many commercially available VLEs from which to select. The University of Wolverhampton uses Wolf and PebblePad as VLEs.

Similar collaboration tools are available for example, a wiki (What I Know Is) is an online application of the web that allows everyone to add and edit the content. The process simplifies sharing of content and is a very effective way to exchange information through collaborative effort. (Jacques and Salmon 2007).

The students were asked whether they benefitted from studying with other students. If yes, they were asked for their reasons for example, learning from each other.

However, concerns have been expressed with the use of wikis: accuracy of content, manageability, use of unfamiliar technology, need for careful monitoring by tutors and the time required for participation. (Croft et al. 2010). The author's online tutor group failed to complete their wiki task primarily due to the challenge of group online working to a deadline.

"Another teaching concern is utilizing the collaborative capability of computer conferencing .. What we know about structuring and facilitating higher-order learning in a text-based environment is sketchy and largely intuitive." (Garrison et al 2000, p.97). As an online learning designer, this is a particular concern.

3.7 Online support

Who provides technical support needs to be considered. Lewis and Allen's (2005, p.60) experience is that *"individuals who are new to using virtual communication tools need a certain level of technical support and that this can be extremely time consuming."*

The author therefore plans to form a course team including learning technologists, pedagogic experts and content specialists (e.g. librarians).

The Salmon five-stage model provides an example of how participants can benefit from increasing skill and comfort from working online and networking with each other, and what the e-moderator needs to do at each stage to help them achieve this success. (Jacques and Salmon 2007)

As can be seen from Figure 2, the five progressive stages are:

1. Access and motivation
2. Online socialisation
3. Information exchange
4. Knowledge construction
5. Development

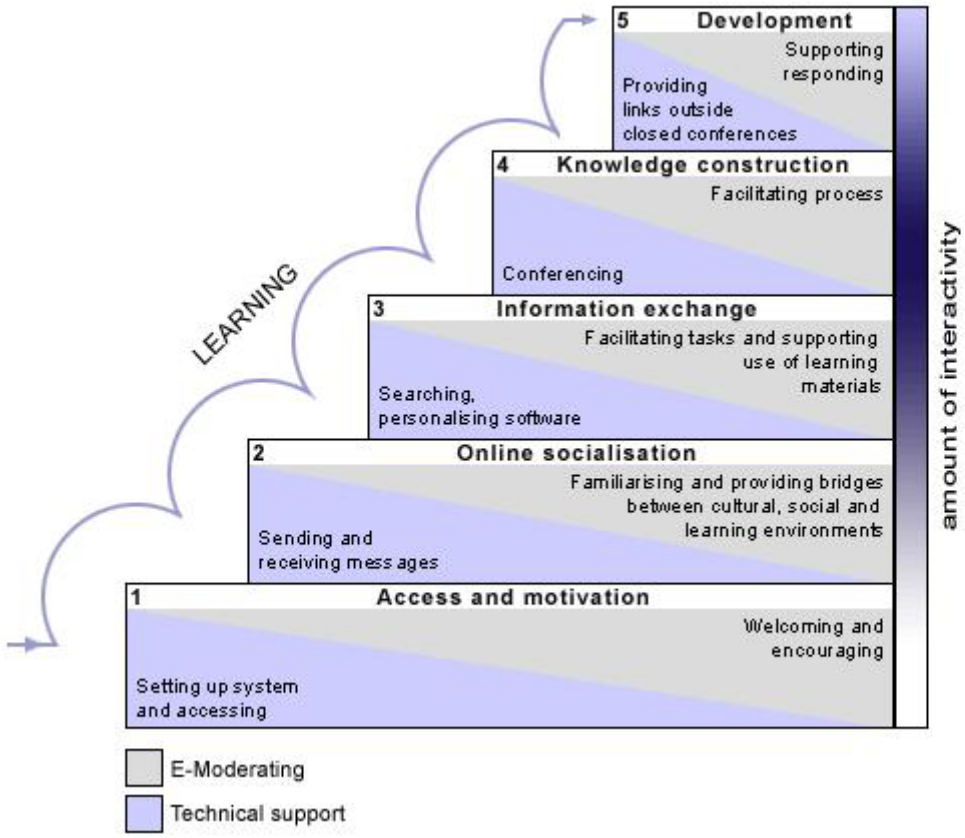

Figure 2. Model of teaching and learning online
(Source: Salmon, 2004, p.29)

Lewis and Allen (2005) find the following activities helpful during the induction stage:

- Introductions
- Narratives
- Technical introduction to the ICT infrastructure
- Ice-breakers
- Ground rules
- Surfacing and discussing hopes and fears of community members

The online learning design is therefore to include induction stage activities.

Some guidelines in online communication practice, often called “netiquette”, are generally regarded as good practice Lewis and Allen (2005).

A good example was Australian Flexible Learning Community (2003).

3.8 Summary

The challenge for the student simultaneously learning a new subject and technology has been identified. Although online learning can widen participation and increase critical

thinking there can also be a move from rich oral communication to a leaner written medium.

For an online lecturer the importance of training on new online social and pedagogical skills as well as new technologies is emphasised. There however, remains the outstanding issue of motivating lecturers to make the change to online teaching.

The differences between asynchronous and synchronous tools and their roles have been analysed. The concept of a Community of Inquiry and the importance of social interaction have been introduced.

Virtual learning environments and collaboration tools were considered. The significance of online support was explained with the aid of the Salmon five-stage model.

In conclusion, it is the author's view that online pedagogy requires a move from *"sage on the stage to guide on the side"* King (1993 cited Bradwell 2009, p.42).

4 Research Findings

4.1 Research methodology

As the University of Wolverhampton is expanding its online provision, it has appointed an Online and Distance Learning Project Director. As part of this research he was interviewed about the University's strategy and plans for online and distance learning.

During the interview comprehensive notes were made and the summary checked for accuracy with the interviewee before inclusion in this paper.

A semi-structured interview format was chosen because as Cousin (2009, p.71) explains *"semi-structured interviews allow researchers to develop in-depth accounts of experiences and perceptions with individuals."*

The first year Construction Law undergraduate module forms part of the HNC Building Studies course. The course aims to develop students with a technical understanding of the construction industry process including the application of management and technology. The course is developed with input from industry professionals to ensure that it is up to date and meets the needs of industry.

The course is delivered only on a part time basis over two years. As such students have the opportunity to attend this course through day release from their relevant day to day employment. It was previously delivered in the evenings.

The course bridges the gap between school and a degree programme. Those students with a merit profile can access a RICS accredited degree course at the second year undergraduate stage.

The 21 current module students who are studying the Construction Law module face to face on campus for the HNC in Building Studies were surveyed both in class and online

about their learning experiences and possible online study. A survey was chosen due to the number of students and potential difficulties in arranging more time consuming interviews.

4.2 Interview with the Online and Distance Learning Project Director

The University of Wolverhampton's Online and Distance Learning Project Director's interview on 7 June 2012 is summarised below.

The University of Wolverhampton's strategy for online learning is to:

1. Increase flexibility for on-campus and off-campus students. Some elements of a course can be studied online and at a distance.
2. Extend our student body in response to possible reduced student numbers due the fees increase. The University will deliver a broad undergraduate and postgraduate programme in the UK, overseas and online.
3. The University has a long tradition of distance learning provision and has decided to remain in this market.

The University currently uses PebblePad as its Virtual Learning Environment (VLE). It has no prescribed view about the synchronous platform provided it is compatible with the VLE.

The biggest headache is working across the University. To combat this there is a committee with representatives from all the Services including: Registry, Quality Assurance, IT and Learning Centres.

"The student experience should be like a train journey with a variety of stops for example, the course advertisement, process of application and enrolment towards the shiny learning experience station finishing with results collection and graduation.
All the stations are in place but not all the lines for example, the online payment per module track is not fully laid yet."

The University already delivers a number of pilot programmes:

- A LLB
- A LLM Common Professional Examination
- A number of other programmes for the School of Education Futures in collaboration with SENCO

The plans for the next academic year are predominantly fully online postgraduate courses including:

- Construction Project Management
- Master of Business Administration
- Public Health
- Military History

The planned online undergraduate level 4 Construction Law module fits in with University's plans to offer more flexibility.

4.3 On campus first year undergraduate Construction Law student survey

The first year undergraduate (level 4) Construction Law module is currently taught on campus using a mixture of lectures and tutorials.

The module aims to develop understanding of the English legal system, law of contract and to introduce key procurement approaches, tendering procedures and forms of contract applicable to building projects.

The 21 current module students who are studying for an HNC in Building Studies were surveyed both in class and on-line about their learning experiences and possible online study.

All the students who attended class on 1 May 2012 completed the survey (See Appendix1). Unfortunately, as this was the last lecture of the module and all the assessments had been submitted, only two students attended.

As there were only two results; they are not representative nor are two people's opinions' generalizable.

Both students:

- Were part-time aged between 26 and 35;
- Considered themselves to be competent with IT and regular users of the internet
- Had a computer with internet broadband access to study
- Neither had studied online before

These students therefore seem to be possible online learners as they considered themselves to be competent with IT, regular users of the internet and had a computer with internet broadband access to study.

They both responded that they benefitted from studying with other students for the following reasons:

- Student 1 wrote *"Yes, social support"*
- Student 2 wrote *"Learning and sharing knowledge, ideas and research with each other. Being with people who understand your learning needs"*

Collaborative learning activities are to be included in the design.
When asked how important it would be for them to be able to receive answers to their questions in real time for example, by a webinar or telephone conference their responses were:

- Student 1 wrote *"Very important"*
- Student 2 wrote *"Quite important, it assists in making decisions quickly"*

If possible, synchronous tools enabling live communication are to be included in the online learning design.

When asked whether they would choose to study online, their responses were:

- Student 1 wrote *"No. I prefer taught lessons."*
- Student 2 wrote *"I may be studying on-line next year, as it fits in with my work pattern, but prefer classroom study as it's easier to absorb information"*

The final comment is intriguing and the original participants could be interviewed to interrogate in more detail the responses given. It is however encouraging that there seems to be a demand for online learning.

The whole class was sent the same survey by email on 24 May 2012 via the module virtual learning environment. There were no responses. The author suspects that this was because it was towards the end of the academic year and many students do not arrange for their university email to be forwarded to their personal email addresses.

Nevertheless, the survey could be re-used next academic year if further data was needed. Also, focus groups could be held with more students to identify common themes from a wider voice.

4.4 Summary

The task undertaken by the Online and Distance Learning Project Director is a challenging one as Cornford and Pollock (2003, p.77) have warned *"attempts to build the virtual university from the bottom up, course-by-course, without reconstructing the basic structures of the university, appear to be very slow, labour-intensive and highly prone to failure."*

The University of Wolverhampton online provision is in line with the findings of White et al. (2010).

The students surveyed considered themselves to be competent with IT, regular users of the internet with broadband access via computer for study. However, neither of them had previously studied online.

They benefitted from studying with other students for social support and learning from each other. They differently valued synchronous interaction with the lecturer. There was a preference for classroom lessons but also an identified need for online study to fit in with work patterns.

5 Implications for design of online learning

This section considers the implications for the design of online learning for a first year undergraduate Construction Law module.

- Assumptions
    - The author makes the assumption that the business case including finance and the market for putting this module online has been passed.

- Virtual Learning Environment
  - The University supports PebblePad as the VLE for online delivery.
  - Include induction stage activities.
  - Devise collaborative learning activities.
  - Incorporate regular feedback.

- Online academic material

  - For example, the main textbook (Ashworth 2012) for the Construction Law module is not currently available online. However, the author recently attended a webinar delivered by the publisher (Pearson). Pearson supports other law textbooks with online exam-style questions with suggested answers, MCQs, flash cards, glossary, legal update and news.

  - To contextualise the Health and Safety Law, Health and Safety Executive's Worksmart videos featuring stories about accidents, near misses and risks to health and safety in the construction workplace can be used (HSE, 2011)

  - *"It may be appropriate to include videoed lectures online to introduce the topic and create a more personalised approach."* (Croft et al. 2010, p.35). As this module is also taught on campus this approach would be adopted.

  - However, beware that online resources can disappear without notice for example, Australian Flexible Learning Community (2003).

- Synchronous Meetings

  - These present two main challenges: IT and timing. The author attended a Webex seminar which offers video, audio and text chat pane connectivity. Initially, she could not hear but this was resolved by the IT help desk. However, students may have IT compatibility and operability issues without IT support. Also, a key driver for online learning is its flexibility and finding a suitable time for a synchronous meeting factoring in students' other commitments and time zone differences will not be easy.
  - *"Students felt video conferencing would not be a viable addition to the course, with issues of cost , synchronicity, availability, personal preferences, technological difficulties/availability, and the constraint of needing to be available at a predetermined time and location all cited."* (Croft et al. 2010, p.50).

- Non-academic support

  - Form a team including learning technologists, pedagogic experts and content specialists (e.g. librarians). For example, develop guides for the new technology and online study skills.

- Liaise with your administration team. *"The importance and quality of support provided by the administrative team (Student Advisers) was found to be high."* (Croft et al. 2010, p.44).

As Salmon (2004, p. vii) argues

> *"Web utopians are predicting virtual universities with very low cost learning and truly effective 'any time, any place' student interaction. They say that the need for expensive campus buildings or large corporate training facilities will disappear along with the requirement for learners to physically congregate. The 'Web-phobes' are very worried that the benefits of learning together may be lost and that it will be a bad day for knowledge, for feelings, for the joys of gatherings and groups."*

It is the author's view that the challenge is to combine the best of both views to create an online pedagogy for Construction Law in UK higher education.

6 Conclusion

This paper concludes by considering online learning from student, academic and university perspectives.

There has been recognition that it can be difficult for students to balance study with work. Online learning facilitates flexible learning and there does seem to be a market for such mode of delivery. Nevertheless, it challenging for students to simultaneously learn a new subject and technology.

However, the transition of existing courses from face to face to online delivery is not straightforward. Online learning has its own pedagogy which is perhaps not familiar to lecturers. Moreover, with the current HE promotion criteria, there is little to motivate academics to change their delivery from content dissemination to facilitating independent activities and learning.

In addition, it is recognised that online provision is not cheap to develop or deliver. With low tutor to student ratios advocated it has to be questioned whether such delivery fits the requirements of higher education funding models. A possible solution is the use of mixed teams including academics, technologists, librarians and administrative support.

The UK higher education sector has grappled with online learning but it can be argued the sector has not yet truly grasped the opportunities. Current provision is not comprehensive and is continuing professional education focused at first year undergraduate and postgraduate levels. Perhaps the change in funding with undergraduates facing higher fees will be a factor towards the development of more online courses.

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Appendix 1

Student Interview Questions

Introduction

As you may be aware, I am researching delivering this module (4CN003 – Construction Law) on-line.
As current students, I would appreciate your responses to the following questions.

Student

- Are you a [full-time]/[part-time] student?
- Age: [18-25]; [26-35]; [36-45]; [46-55]; [56-65]
- Do you consider yourself to be [expert]/[competent]/[novice] with IT
- Are you a [regular]/[occasional] user of the internet?
- Anything else you would like to add about yourself?

Questions

1. Do you have a computer with internet broadband access to study?
2. Have you studied on-line before? If yes, what? What was your experience like?
3. Do you benefit from studying with other students? If yes, what are your reasons for example, social support and/or learning from each other?
4. How important would it be for to you to be able to receive answers to your questions in real time for example, by a webinar or telephone conference?
5. Would you choose to study on-line? What are the reasons for your answer?

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Practitioner Research: The Forgotten Paradigm in Built Environment Scholarship

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Abstract:
This paper introduces a model of practitioner research and proposes this as an alternative paradigm for use within the built environment discipline. It defines the concept in terms of research whose primary purpose addresses the needs of professional practice, rather than theoretical or policy concerns, and which also utilizes the researcher's experientially-gained knowledge as a methodological device. The model's academic pedigree is scrutinized within the context of historical and contemporary approaches to knowledge production. It is seen to draw upon the Aristotlean notion of practical knowledge, and to belong within a long epistemological and methodological tradition, having particular resonances with current approaches to social research, and to recent discourse surrounding the knowledge economy. The paper concludes that practitioner research represents a forgotten paradigm within the built environment, and one which is capable of satisfying the competing demands both for professional relevance, and also for academic rigour.

Keywords:
Built environment, mode 2, practitioner research, qualitative research, research-practice divide.

1 Introduction

The built environment as an academic field emerged from, and is often defined in terms of, the property and construction professions that it has traditionally served (Temple 2004). This vocational focus reflects the origins of the field in the 1960s as being primarily concerned with the delivery of programmes of study leading to admission to the types of profession referred to above (Ashworth 2009, p. 27).

As the field has matured since its early beginnings - and started to lay claim to the status of an academic discipline in its own right (Langford 2009) - it has increasingly engaged in academic research in addition to these traditional teaching-related activities. Despite the vocational orientation of most built environment research *topics*, there is, at least, anecdotal evidence that the *treatment* of these topics by its researchers may, on occasion, be acting as a barrier to engagement by potential stakeholders in industry and the professions.

This so-called research-practice divide is frequently remarked upon by practitioners and policymakers in the field and – despite the obvious sensitivities involved in this - is also the subject of occasional published commentary from within the built environment academic community itself (for example, Koskela 2011). The phenomenon is not unique to the built environment. It has been extensively discussed in the academic literature relating to other professions, for example in nursing (Hutchinson & Johnston 2004) and management (Starkey & Madan 2001).

This paper briefly considers some of the possible causes for the research-practice divide in a built environment research context. It then defines a notion of practitioner research and proposes this as one mechanism by which the gap might be closed. It explores some of the epistemological challenges presented by the concept and proposes solutions based on the adoption of some alternative approaches to research methodology within the discipline.

2 The Research-Practice Divide

2.1 Criticism of Academic Research by Practitioners

A criticism frequently levelled at academic research by practitioners is that it displays a naïveté about the nuances and complexities of the subjects being addressed (Reed & Procter 1995, p. 3). Because of this, research may be dismissed as lacking in credibility by a practitioner audience if it is seen as over-simplistic, or focusing more on the theoretical preoccupations of an academic audience, than on the actual concerns of its purported end-users in the professions.

Such criticisms might arise for a number of reasons. Most obviously, it might simply be that – as professional academics - those undertaking the research lack the necessary familiarity with the professional environment to enable them to fully understand it, and therefore to establish a meaningful dialogue with practitioners.

Alternatively, as many built environment academics do have at least some background in relevant areas of practice, the problem might often be more to do with the demands – or, at least, the perceived demands – of the research environment itself. In relatively new and emerging fields of academic endeavor the conventions of academic research are often modelled closely on those of the traditional natural sciences. This was true of sociology in its formative years and Dainty's (2008) study of articles published in a respected peer-reviewed journal within the field tend to support the view that this is also true of today's built environment research community.

The methods employed within such research traditions emphasize the importance of researcher detachment from the objects of study, and of the importance for science of developing general theories. According to this view, the researcher must, of necessity, remain an *outsider*, and must maintain objectivity by basing their findings solely on neutral observations, uncontaminated by any previous *insider* knowledge.

2.2 Relevance or Rigour?

A closely-related issue concerns the disciplinary priorities of the built environment academic community, and the ways that these relate to those of its associated professions. As the built environment academic discipline has grown to maturity there is evidence that, to some extent, its former practitioner academics may be adopting the mores of their new environment in preference to those of practice. For example, in the context of the construction management (CM) sub-discipline, Murray (2009, p.53) describes the development of "two separate CM communities of practice and cultural norms" and a resulting "stand-off" between its professional and academic branches.

As a consequence of these cultural changes there is an increasing tendency for academics to view research in terms of academic, rather than practice-based, norms. This might, for example, involve defining a research project in terms of current theoretical debates within the academic literature, rather than primarily as a response to a specific problem identified by practitioners. Equally, perceptions about the demands for academic rigour are more likely to lead to reliance on the strict application of formal methods, rather than on seeking solutions to problems via more informal and - it might be argued by the practitioner - potentially more creative approaches.

In this sense the challenge of the relevance gap can be seen in terms of a tension between the practitioner's need for *relevance*, and the academic's need to demonstrate the value of their research work according to accepted conventions of academic *rigour*. The difficulty, in a vocational field like the built environment, is that conventional scientific and outsider views of the knowledge creation process fail to acknowledge – and to build upon - that which is well-known by practitioners in the professional environment, but which is not scientifically proven according to traditional methods.

The notion of *practitioner research* is therefore proposed within the remainder of this paper as one means by which these issues might be resolved in a built environment context. The term is introduced and defined in the next section, and presented as a means of satisfying the built environment practitioner's requirement for relevance in research. The following two sections then explore theoretical and methodological aspects of the proposed approach with a view to evaluating the extent to which it might also be capable of demonstrating the required degree of rigour demanded by the academic world.

3 Practitioner Research

3.1 Two Essential Requirements

At one level the term 'practitioner research' can simply be defined as research which is undertaken by practitioners, rather than by professional academics. Although clearly a valid use of the term, such definitions obscure the substance of what is different between much of the research which is presently undertaken in the built environment field, and that proposed here.

For the purposes of this paper 'practitioner research' in a built environment context is therefore restricted to research projects where practitioner knowledge and understanding

are central to both the purpose and the methodology of the research. Specifically, drawing on aspects of Reed & Procter's (1995, pp. 11 - 31) observations in the context of health care research, it will be described as research:

(a) which defines its purpose primarily in terms of the practice needs of one of the related built environment professions, rather than by reference to the policy or theoretical concerns of the built environment academic discipline, and

(b) which uses the researcher's experientially-gained professional practice knowledge and understanding as a methodological device, both as a direct and legitimate source of data, and also as a tool for enhancing the quality and insight of the analysis.

3.2 Research Purpose

Whilst practitioners see research as being concerned with the resolution of specific problems in practice, the academic world takes a more detached approach. Their priorities are as likely to be informed by "gaps in the literature" as by reference to what is already common knowledge within the professional environment. They are also more likely to take a more theoretical and policy-driven view of the research purpose, seeing it primarily as a means of making a more long-lasting, and context-independent contribution to knowledge, than simply in terms of fixing a particular aspect of practice that is currently malfunctioning.

These differences conceal what is arguably a more fundamental distinction between the two worlds, namely that between research purposes which take either an *insider's* or an *outsider's* perspective. The priorities of the (social science) outsider researcher, and the ways in which these contrast with those of the practitioner are articulated by Reed & Procter (1995, p. 11) in the following terms:

> "For the social science researcher or 'outsider' the aim of the research is usually to contribute to the body of social science knowledge….therefore, practice is only examined for what contributes to an understanding of practitioner action, not practitioner knowledge."

In direct contrast to this, the practitioner's requirement for research is, of course, precisely that it should contribute to the development of practitioner knowledge, thereby enhancing the professional knowledge base and leading to improvements in practice. The suggestion in this paper is that some of the research undertaken within the built environment might usefully define its purpose primarily in terms of the practice needs of the relevant professions. This is therefore a challenge to the academic world to focus aspects of its research work on the development and application of the professional knowledge base of those professions.

3.3 Research Methodology

The second requirement for practitioner research, as defined in this paper, is a methodology which regards the researcher's experientially-gained professional practice knowledge and understanding as a research resource, and which draws unashamedly on this. Following Polanyi's (1966, p.4) familiar notion that "we can know more than we can tell" a significant aspect of this resource will take the form of what he described as

tacit, rather than explicit knowledge. In the language of research it will form a component of the research data, and will also inform the researcher's analysis of those data.

As previously discussed, it is not envisaged that 'practitioner research' will always be undertaken exclusively by practitioners. Where practitioners have the aptitude and the inclination for this, they may indeed choose to undertake research themselves. However, the required practice-based knowledge and understanding might equally be harvested via alternative means. Perhaps most obviously, this might be made available through collaboration between academics and practitioners in order to produce the required synthesis of this resource with the research skills necessary to make effective use of it. In this context what is being proposed echoes what Reason (1988, p. 1) has described as 'co-operative experiential inquiry' rather than a more traditional collaborative arrangement whereby the researcher gathers data from a practice-based research subject for analysis and subsequent reporting back to practice.

A further approach draws on the fact - previously alluded to – that academics in the built environment field overwhelmingly possess significant experience of professional practice in their own right. It follows that the approach advocated here can be undertaken by many academics in the field, even in the absence of collaborative arrangements with existing practitioners. To be effective this might call for continued immersion in, and engagement with, the world of practice, and a proactive approach to maintaining one's professional development and subject knowledge. However, this is arguably no greater a commitment than is already necessary for built environment academics to perform as effective teachers in the discipline.

By drawing on this resource the research can avoid the criticisms of naïveté and over-simplification described above, and can build on that which is already known, rather than having to start from an artificial position of feigned ignorance. The challenge, of course, is to demonstrate that such an approach is also capable of demonstrating the necessary degree of academic rigour demanded by the research community. This aspect is addressed in the remaining sections of this paper.

4 Philosophical Traditions

4.1 Practical Knowledge

On first impressions, the proposed combination of research goals which are pragmatically rather than theoretically determined, and methodologies which draw on experientially gained tacit knowledge rather than detached observation, might be seen to represent something of a challenge to conventional notions of academic knowledge. These notions, according to Barnett (2000, pp. 16 & 17), see knowledge in terms of "ordered conceptual frameworks", an "edifice, having a durable character", or "bodies of knowledge…with systematic strategies to add to those bodies of knowledge through research".

However, he also draws attention to a parallel tradition in western thinking that is as old, or older, than these ideas, and which echoes the concept of practitioner research

proposed in this paper. Rather than seeing knowledge as an edifice which is self-consciously created by external actors, this tradition recognizes that it can also be generated *in action*. Within this tradition the knowledge is seen as embedded within human action, and being inseparable from it.

These ideas were articulated by Aristotle in *The Nicomachean Ethics* where he distinguished the concept of ep*isteme* (theoretical know-how) from those of *techne* (technical know-how) and *phronesis* (practical wisdom). Barnett (1997, p. 12) describes the latter two concepts, collectively, as Artistotle's notion of 'practical knowledge' which he interprets as asserting the legitimacy of knowledge gained through practice.

Barnett also cites the history of western universities as evidence of this alternative tradition of knowledge. He notes that the earliest mediaeval universities were established as "high level professional schools" for vocational training in the law, medicine, and theology and that the emphasis was therefore practice-based, rather than theoretical.

The connection between knowledge and action is not simply of historical interest but has also attracted increasing attention throughout the twentieth century and beyond. In the field of professional education this includes Schön's (1983) seminal work on the *reflective practitioner* with its related concept of *knowledge in action*. In politics and sociology the Marxist notion of *praxis* – often associated with the work of Gramsci (2011) – also draws an intimate connection between ideas and their realization through practical action. In business and education these ideas also underpin Kolb's (1984) concept of *experiential learning*, as well as the practice of *action learning* (Brockbank & McGill 2003). In a research context the latter two business-related practices have obvious parallels with the techniques of action research developed by Lewin (1946) and others.

4.2 The Knowledge Economy

The above discussion demonstrates that there is nothing new in the idea, proposed in this paper, that the process of formal knowledge creation can legitimately draw upon tacit, experientially-generated knowledge from the workplace. Indeed, it might be argued that recent developments have now catapulted such ideas into the intellectual mainstream. These developments were foreshadowed in Drucker's (1968) insightful work, *The Age of Discontinuity*. In this prescient account of future (now present) society he anticipated the effects of information technology, globalization and mass education and introduced the terms "knowledge economy", "knowledge society" and "knowledge worker" into the language.

More recently, the impact of these changes on the research enterprise was famously articulated by Gibbons et al (1994) in terms of a move from *mode 1* to *mode 2* knowledge production. Mode 1 is identified as the disciplinary, theoretical knowledge which has traditionally been generated in universities through research. The authors' thesis is that this is now being displaced by a more dynamic process (mode 2) where knowledge is increasingly generated "in the context of application" as a response to immediate problems identified in the working environment, rather than in universities.

The knowledge so-generated is no respecter of disciplinary boundaries or hierarchical power structures and is said to be trans-disciplinary in character. It will often be produced by transient teams of workers. Significantly it will rarely be formally codified, and will therefore only be apparent in the solution to the problem it was designed to address. The quality of the knowledge so-produced is then evaluated, not by formal academic conventions, including peer-review, but by more pragmatic criteria based on its overall utility.

4.3 Knowledge Management

The significance of Polanyi's (1966, p. 4) concept of *tacit* knowledge to the process of practitioner research has already been referred to on several occasions. Before concluding this discussion, a further related strand of thought, also associated with the development of the knowledge economy, should therefore briefly be introduced. This concerns the detailed consideration that has been given to the tacit knowledge concept in the burgeoning volume of literature on 'knowledge management' that has emerged since the early 1990s.

Like the concept of mode 2 knowledge production, the knowledge management field is also a product of the knowledge economy. As knowledge has grown in importance within modern society it is increasingly being seen as a key asset within organizations, the effective management of which is likely to provide a source of competitive advantage (Hislop 2009, p. 3). Because much of a firm's knowledge resides within the minds of its employees in tacit form this has understandably generated a renewed interest in Polanyi's ideas - by Nonaka & Takeuchi (1995) and others - as well as a recognition of the central role of tacit knowledge in contemporary organizations.

In the context of the current discussion, this recognition of the importance of tacit knowledge within a contemporary body of academic literature is itself significant. The different approaches to the treatment of this intangible concept by academic writers are also of interest, and preface the discussion of methodological traditions in the next section. As demonstrated by Hislop (2009, pp. 18 – 49) these approaches fall into two distinct categories which echo the two parallel views of knowledge production previously discussed, and highlighted by Barnett (2000, pp. 16 & 17).

In the knowledge management field the dichotomy is between what Hislop identifies as an *objectivist* and a *practice-based* perspective of knowledge. The former – which he describes (p. 19) as being "deeply-rooted in the philosophy of positivism" – sees knowledge as objective, capable of existing independently of people in a codifiable form, and privileges explicit knowledge over tacit knowledge, which it regards as less rigorous and subjective. Objectivist approaches to knowledge management therefore typically seek to capture, and to codify, the tacit knowledge of employees, and to convert as much of it as is possible into explicit form.

In contrast, the practice-based perspective might be seen as being synonymous with the idea of *knowledge in action* discussed above. This perspective – which Hislop (p. 33) describes as "an epistemology of practice" - rejects the notion that tacit knowledge can be separated from either the people who possess it, or the practice that gave rise to it. It therefore regards knowledge as both personal and context-specific. Its approaches to

knowledge management therefore shun attempts to generate objective, value-free knowledge and instead focus on facilitating effective communication between employees to enable tacit knowledge to be shared within the organization. Significantly, in common with the notion of practitioner research advocated here, the value of tacit knowledge is recognized as a resource *in its own right, and in its entirety*, without the need to first transform it (or some of it, as parts of it will not be capable of transformation) into a more conventional format.

5 Methodological Developments

5.1 Ideographic and Emic Approaches to Knowledge Production

This *action-based* tradition of knowledge creation therefore has a long history which continues to develop. As has been seen, it is characterized by an attention to the detail and complexity of particular contexts and situations which can only be achieved through long-term and intimate connection with them by the knowledge creator. This, of course, is at variance with the scientific tradition's emphasis on the creation of general theories, undertaken through pre-planned and detached observation.

Nevertheless, this theoretical tradition has its own methodologies which are quite distinct from those employed within the sciences. These are often described as *ideographic*, as opposed to *nomothetic*, and as taking an *emic*, as opposed to *etic* approach to the subject of study. Sayer (2000, p. 3) describes *ideographic* methodologies as being concerned with "documenting the unique", and contrasts this with the general "law-seeking" priorities of *nomothetic* science. Equally, using the terminology which Pike (1954) borrowed from linguistics, an *emic* approach seeks to understand contextual meaning and purpose, and will often be synonymous with an insider's view of a subject. This is quite different from the outsider's *etic* approach which seeks to make sense of particular instances in terms of their relationship to existing theories or frames of reference.

5.2 New Paradigms in Social Research

Historically, ideographic and emic approaches to scholarship have been associated with the humanities, rather than the sciences. However, since at least the early 1980s they have increasingly been adopted within the social sciences. Whilst initially favouring those which replicated the methods of the natural sciences Erlandson et al (1993, pp. 5 - 9) describe a growing disillusionment by scholars with techniques which were not always capable of generating credible accounts of the social world.

This generated a move to what was originally described as "new paradigm research" (Reason & Rowan 1981) which sought to legitimize, within the social sciences, some of the more subjective, researcher-centric methods which had previously been associated only with the humanities. Although having many different forms the iconic version of the emergent paradigm is arguably Lincoln & Guba's (1985) *Naturalistic Inquiry*. In this seminal text they set out (ibid, pp. 39 – 43) an approach to research which seeks "ideographic interpretation" by a "human instrument" through the "utilization of tacit knowledge". They envisage the use of "qualitative methods", "negotiated outcomes"

with research participants and research outputs which adopt a "case study reporting mode".

Today, this new methodological tradition within the social sciences is more usually described simply as 'Qualitative research' - now regarded as far more than an alternative (non-quantitative) type of data collection and analysis in research that otherwise conforms to traditional concepts of the scientific method. Kidder & Fine (1987) describe the latter simply as 'qualitative' (with a small 'q') research in order to distinguish it from the more usual use of the term. Rather, Qualitative research now represents a self-contained paradigm which challenges the notion that natural science methodologies – with their emphasis on the objective measurement of inanimate objects – can meaningfully be applied to the study of people, or of society.

As these ideas have gained increasing purchase within the social sciences there has been an understandable move away from methods which seek to distance the researcher from the research participants, in favour of those which emphasize his or her role as a part of the research setting. As a response to these developments a range of techniques – most notably the concepts of *reflexivity* (Alvesson & Sköldberg 2000) and *bracketing* (Moustakas1994) - have been developed in order to accommodate the close involvement of the researcher with the research setting.

5.3 The Built Environment Context

These developments suggest that the model of practitioner research proposed within this paper can comfortably be accommodated within the now well-established tradition of Qualitative research methodology. Indeed - as is clear from the burgeoning body of literature on practitioner research in health and social care (for example, Sanders & Wilkins 2010) - this is already the case within some professions. The present lack of familiarity with the concept of practitioner research within the built environment discipline might simply reflect a more general lack of familiarity with some of the recent developments in Qualitative research within the wider academic community identified in this paper.

Dainty's (2008) study has already been referred to in this context. He describes his findings as reflecting (ibid, p. 7) an "ongoing adherence to natural science methodologies and reductionist approaches" within the field. In the context of the diversity of approaches that could potentially be adopted he also notes an apparent reliance on semi-structured interviewing by the small number of Qualitative researchers within the discipline. Finally (ibid, p. 8), despite the tradition of reflexivity which exists within Qualitative research, he draws attention to its absence in any of the papers considered within his study. This suggests, as a first step towards realizing the possibilities of practitioner research, that the built environment research community might first embrace many more of the traditions and techniques that are now a routine part of social research in other fields.

6 Conclusions

Despite its vocational origins, it is suggested by some that a research-practice divide might be starting to open up within the built environment field. It has been argued in

this paper that that this may be due to the apparently conflicting demands – respectively from practice and academia - that research must be both relevant, but also academically rigorous. In the built environment, the latter requirement has tended to generate research which satisfies the requirements of the traditional scientific method. Unfortunately, whilst delivering rigorous findings, these approaches have occasionally failed to satisfy the practitioner's demands for relevance. This paper has therefore proposed the notion of 'practitioner research' as being potentially capable of satisfying the requirements for both relevance and rigour. It is proposed, not as a replacement for existing approaches to research within the field, but as an alternative paradigm, capable of enriching the range of methodologies currently employed.

Whilst offered primarily as a response to the practitioner's demand for relevance, the proposed approach has also been demonstrated within the paper to conform to a longstanding, but recently-reinvigorated, tradition of knowledge creation within the academic world. Drawing on Aristotle's ideas about 'practical knowledge' this tradition finds regular academic expression in such concepts as knowledge in action, praxis, reflective practice, experiential learning, as well as action learning and action research. More recently it is seen to have a particular resonance in the current discourse surrounding the knowledge economy, through the concept of mode 2 knowledge production and the ongoing developments in knowledge management. Within academic research the tradition employs methodologies which emphasize the importance of *ideographic*, *emic* and *tacit* approaches to investigation. Traditionally these have been associated with the humanities but, as has been seen, in recent years they have been increasingly employed as a mainstream strand of social research.

With its origins in professional practice it is perhaps surprising that the built environment discipline has not already embraced practitioner research, as has been seen to be the case in other vocational disciplines. For the reasons discussed, this may be due to the relative newness of the discipline, and to its continued adherence to methodologies which are modelled on those of the natural sciences. Nevertheless, practitioner research is proposed here as an alternative paradigm for use within the field. Given the practice-centered backgrounds of many built environment academics, and the long history of this Aristotlean approach to knowledge production, some might consider it more appropriate to describe it as the built environment's forgotten paradigm.

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STRATEGIES FOR REDUCING CONSTRUCTION WASTE TO LANDFILL IN THE UK

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ABSTRACT

The construction industry in the UK produces up to one third of all waste to landfill. This situation has been targeted by the government through landfill tax and commitment. The commitment has used 2008 as its base year and the target is to reduce construction waste to landfill to half the 2008 amount by the year 2012. Using both qualitative and quantitative research this study aimed at identifying specific issues creating waste in construction projects as well as uncovering potential waste solutions throughout the construction process. Waste prevention was identified as the best waste strategy, as by preventing waste the costs and time required for managing waste are greatly reduced. Solutions to waste at the design stage included making waste a higher priority for the client, reducing the complexity of designs, and earlier contractor involvement. Solutions to prevent waste at the construction included use of prefabrication and early communication of design freezes. In all, the target was found to be achievable but would require construction companies to take it upon themselves to implement the proposed solutions. The value of this research is to provide solutions on how to reduce waste and aid the reaching of the landfill target.

Key Words: design, construction, landfill, sustainability, waste.

INTRODUCTION

In general terms waste is unwanted material. Its original purpose has been met and the material is of no further use in its present state or location. In 2011 WRAP found that the construction industry was responsible for a 120 million tons waste which was estimated as being a third of all UK waste. Waste management has generally adopted the approach of finding a way of moving and disposing of this waste through a series of processes. Historically most of the waste has ended up being disposed of via landfill. In the past this was a cheap option for waste disposal. There was adequate space available. This is no longer the case. Surrey County Council (2011) highlighted that in England and Wales landfill sites

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decreased from 3,400 in 1994 to 2,300 in 2001 with the present number of sites being around 1,500. At present, a high percentage of all waste produced in the United Kingdom is still sent to landfill sites. The volume is increasing to such an extent that other methods of waste management have to be adopted. The view of waste as a resource has further increased the shift away from landfill (Nick Herbert, 2009).

In 1996 the landfill tax was introduced to discourage use of landfill and to encourage recycling. The tax rates, which initially were set low, have subsequently been increased in order to strengthen its behavioural impacts, and more increases are planned. This tax has impacted on the construction industry. In 2000 the DETR found that 24% of construction waste was disposed at landfills compared to 51.2%. In June 2008 the "Strategy for Sustainable Construction" was created. It is a joint industry and Government strategy with an overall goal of enabling England to be world leaders in sustainable construction. One of the key areas of the strategy is waste were the target is to achieve "By 2012 a 50% reduction of construction, demolition and excavation (CD&E) waste to landfill compared to 2008". In the hope of aiding the reaching of this target the objectives of this research are to identify the main issues within a construction project which create waste, as well as solutions to the waste

LITERATURE REVIEW

There is a substantial amount of literature concerning waste within the construction industry. This research will look at waste management towards achieving the government initiative. The waste hierarchy prioritises the different waste management strategies in terms of sustainability with prevention being the best option. It is essential to understand the sources of waste within the construction process. Morris et al (2007) claim that one third of all construction waste can be traced back to decisions at the design period. Ekanayake and Ofori (2000) identified three main categories of waste generation on a construction site namely, materials, labour and machines but highlighted material waste as being of more importance due to the construction industry using mainly virgin materials which are from non-renewable sources. Furthermore they found there to be four chief sources of waste in construction which were design, operational, material handling and procurement (material). In support of this Gavilan and Bernold (1994) identified six source categories of construction waste, with four the same as above. They are design, procurement, material handling, operation, residual and others.

Design Stage

Osmani et al (2007) discovered that architects believed most waste generated during a construction project to be the cause of contractors through such processes as misinterpretation of architects' drawings and specification and on-site logistical and operational activities. In all it was found that designing out waste was considered an ad-hoc activity and architects would only be willing to work with contractors on this process if enticement was provided by clients, mainly through financial incentives. This approach of coordination is supported by WRAP (2008b) whom claim that "It is the contractor who sees where waste is generated on site and who should be able to support the designer in looking for waste within the design". WRAP (2008b) identified processes during the design stage to help minimise waste. These include preventing design variations through understanding the client's needs and the client providing "clearly defined objectives" and designing for site conditions. The need to minimise design changes is supported by Osmani et al (2006) who found, through use of questionnaires that contractors and architects both agreed that late changes due to clients' requirements and design changes were the main causes of waste at the design stage. The

increase in complexity of buildings also affects the amount of design changes. WRAP (2008a) supports this by promoting standardisation of design to reduce complexity. If design changes are necessary all parties involved should be given appropriate and effective notice of them (Faniran and Caban, 1998). Most importantly the design stage should be considered as the stage which offers the greatest opportunity for waste minimisation (Keys et al, 2000). Ofori and Ekanayake (2000) advocated the early involvement of the contractor during the design stage as a means towards waste reduction.

Construction stage waste prevention

One of the main causes of waste at the construction stage was considered by Jones and Greenwood (2003) to be "damage due to mishandling, weather and inadequate storage". Enshassi (1996) claims that having inadequate storage on site can cause waste. However he highlighted that contractors are not conscious of the rewards of providing proper storage. He also recommends having costly materials arriving on site only when needed by providing safer off-site storage. A better material storage solution is Just-In-Time deliveries (Akintoye, 1995). This highlights the need for supply chain management in order to provide JIT production in the construction industry. Vrijhoef and Koskela (2000) state "The basic idea of supply chain management is to recognise the interdependency in the supply chain, and thereby improve its configuration and control based on such factors as integration of business processes. One way to enable supply chain integration is through partnering. Furthermore WRAP (2008a) suggests that engagement with the supply chain can be used to minimise packaging on materials, encourage suppliers to reduce waste at source as well as aiding the setting up of 'take-back schemes' enabling the contractor to return surplus materials to his suppliers. Tam et al (2005) highlight another cause of material waste to be the use of the conventional construction method, which involves a lot of cast in-situ operations. Jaillon et al (2008) discovered that prefabrication can provide numerous additional benefits such as a decrease in time to complete a project and an improvement in health and safety. Material handling was also identified as a construction stage waste contributor, which can be improved through the use of the right piece of handling equipment for the conditions at that time (Cooke and Williams, 2009).

Reuse and Recycling Construction Waste

Faniran and Caban (1998) state "Re-using and recycling waste refers to the reusing and recycling of waste materials, thereby reducing the volume of waste material to be disposed of and discharged back into the environment". To be able to make the most of both waste management techniques it is necessary to segregate waste. This view is defended by (Wimalasena et al, 2009) who believe it is necessary to analyse construction waste so as to better understand the waste problem and help create "targeted recycling programmes". Site Waste Management Plans (SWMPs) help to promote the segregation of waste which allows for the recuperation of materials and also provides a safer working environment (Hill, 2008). SWMPs have now become compulsory on all construction projects of a cost greater than £300,000, within England from April 2008 (WRAP, 2008c). Furthermore WRAP (2008c) claims that the use of SWMPs has reduced the cost of waste management for contractors. In terms of comparison between recycling and reuse of material waste it is better to reuse materials on-site than the recycling of materials off-site, though both are preferable to landfill disposal (Craighall and Powell, 1999). This is down to the facts that re-use on-site saves on transport costs and obviously the cost to recycle materials.

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Table 1: Solutions to help reduce waste to Landfill

	Pre-design and Design Waste Solutions	Overall Mean	Architects	Clients	Contractors
1	Early supply chain involvement in design process, giving waste reduction a top priority	4.37	4.50	4.50	4.18
2	Choosing materials for their durability	4.19	4.25	4.50	3.55
3	Longer project programmes and better lead times	4.15	4.17	3.75	4.09
4	Making the Site Waste Management Plan (SWMP) part of the pre-design stage	4.04	3.75	3.25	3.64
5	Submission of Deconstruction plan as part of planning permission application	4.00	2.83	4.00	4.45
6	Training for clients on the benefits of a well defined clients brief	4.00	4.08	3.50	3.36
7	Setting targets for the recycling and reuse of waste	3.96	4.00	3.25	3.55
8	Using partnering as a vehicle for implementing waste management and minimisation practices	3.74	3.42	3.75	4.00
9	Use of supply chain to influence manufacturers to reduce materials waste (i.e. packaging)	3.59	3.58	2.75	3.82
	Construction and Demolition Waste Solutions				
10	Using Off-site Prefabrication	4.33	4.50	3.75	4.09
11	Early communication on design changes between all contract parties	4.15	4.17	3.75	4.18
12	Use of design freezes	4.07	4.33	3.25	3.73
13	Use of quality management to reduce defects	3.93	3.83	3.25	4.00
14	Use of modular construction	3.93	4.17	3.75	3.64
15	Waste efficient procurement (i.e. materials logistic plan Just-In-Time Delivery, etc.)	3.81	4.08	3.75	3.55
16	Instigation of take-back schemes with suppliers for surplus materials	3.74	3.75	2.00	4.00
17	Ensuring the correct handling equipment is available for diverse weather conditions	3.67	3.75	2.00	3.82
18	Using deconstruction instead of demolition	3.33	2.83	4.50	3.45

METHODOLOGY

The approach chosen was to use qualitative research to assist quantitative. It was decided to use semi-structured interviews as the qualitative information gathering technique. In order to get a balanced perspective it was decided to approach the three key players namely, the client, architect and contractor. Personnel with at least 10 years experience were targeted. The quantitative aspect includes a questionnaire survey. The respondents were sourced through use of contact details on the WRAP website of companies that have signed up to the halving waste to landfill commitment, as well as using contacts from the local construction industry. The total respondents numbered twenty seven. Eleven were from contracting firms, twelve from architect firms and only four were from client organisations. The return rate was less than expected with around with nearly 200 surveys sent out via email.

QUANTITATIVE RESULTS AND DISCUSSION

Table 1 below shows possible solutions to reduce construction waste to landfill based on the survey result.

Pre-design and design stage solutions

In terms of overall solutions to the design stage it has been found that waste reduction should be considered early in the design process. This will require an increase in priority, which is unlikely to happen unless it is required by law, provides substantial cost benefit or demanded by the client. In terms of cost benefit it should be highlighted that prevention reduces the amount of waste produced and therefore should fabricate cost savings by reducing costs of unnecessary waste. The choosing of materials for durability is a simple measure in theory. In terms of the client this was the highest ranked solution to waste. This is logical as more durable materials will last longer requiring less change to the clients building and therefore less disruption as well as less expenditure. The increasing of time available for a construction project is unlikely to happen as discussed earlier, though it would most definitely reduce waste production. Shen et al (2002) found that due to heavy penalties for time overruns imposed by the client, contractors are diverted from investing time into environmental management. Lack of segregation of waste, has already been mentioned as an issue impacting on recycling and reuse. However it seems that contractors need to be educated on the benefits as well as the unquantifiable benefit of improving their Corporate Social Responsibility (Tam and Tam, 2005). It is accepted that in some cases segregation is not feasible such as small sites or small projects. In these cases it will be inevitable that waste that could be recycled will end up in landfill.

Construction stage minimisation solutions

The greatest generator of construction waste is the concreting process so any lessening in the amount of on-site concreting equals a reduction in waste (Baldwin et al, 2009). One method of reducing traditional in-situ concreting is to make use of off-site prefabrication. This has been verified by this research with architects, clients and contractors, agreeing that prefabrication are a very effective means of reducing construction waste. Prefabrication is a manufacturing process which takes place in a factory designed for it and thus allows for better control. The repetition of prefabricated units also allows for waste to be removed through refining the process. Furthermore Jaillion et al (2008) found that a 70% time saving could be gained through the use of prefabrication techniques in comparison to in-situ construction. Prefabrication is not without its problems. Due to size of units they are not suitable for small sites. They may be damaged during delivery and more time is required at the early stages of a project to design for prefabrication and allow for production (Baldwin et al, 2009). However this extra time taken before construction can commence could be used to implement proper waste management throughout the project as well as allowing for time to further reduce waste through design. In full traditional methods of construction need to be reduced as much as possible which is further supported by findings that modular construction was ranked fifth as an effective method of waste prevention. The second and third ranked methods of reducing construction waste concern design changes. It has been identified at the literature review, the interviews and validated by the questionnaire as a large cause of waste. The solutions provided to reduce the effects of design changes are the early communication on design changes between all contract parties as well as the use of design freezes. In support Latham (1994) found that if an effective communication network was not defined, then bad practice would continue throughout the construction industry. Therefore it is important to ensure effective lines of communication are set up. Also the use of partnerships would

encourage better relations between disciplines and therefore better communication and understanding. The late changes to designs during the construction phase could be reduced through design freezes. This is otherwise known as design fixity. Cooper et al (2005) explains that design fixity is where the design elements for certain processes are signed off upon agreement and from this point cannot be changed. Design fixity therefore provides the contractor with certainty over the construction process and project which will reduce waste as well as keep the project on schedule.

Reuse and recycling solutions

The only solution to improve recycling and reuse of construction and demolition waste that was recognised as being effective by all the key players was the use of SWMPs. These plans improve recycling and reuse as they require each sub-contractor and main contractor to identify their expected waste streams. This then enables the planning of what can be recycled and when. It also allows for the planning of reuse of materials. Furthermore if the SWMP is integrated in at the design stage it will allow for better evaluation of waste and can allow for greater reuse of waste within the design. In addition Tam (2007) found that if it is integrated at this stage it can help identify areas where waste can be reduced.

CONCLUSION

This research has shown that whilst only just over one third of questionnaire respondents signed up to the commitment, all displayed an awareness of the issues of waste within construction. Landfill space is running out. If the target is not a success then stronger measures will have to be implemented by government. However this should not be the case as there are enough opportunities and solutions that can be utilised to prevent the disposal of waste at landfill. In addition if such methods are adopted cost savings can be made which could be especially significant in these current times where construction companies are making a loss on projects just to keep their cash flowing. Prevention is the best cure and can also provide the most benefits but does require collaboration between the key players in the construction industry. Reuse and recycling is easier to implement and may be the uncomplicated answer to fulfilling the commitment.

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ADDRESSING CORRUPTION IN INFRASTRUCTURE PROVISION IN DEVELOPING COUNTRIES

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ABSRACT

Financial leakages in infrastructure services which includes kickbacks, bribery, fraud and embezzlement is damaging. It damages developed and developing countries, hence, resulting in projects which are unnecessary, unreliable, unwanted, unscrupulous, abandoned, and over-priced. This leads to poverty, loss of life, economic damage and underdevelopment (Transparency International 2011). Corruption erodes the benefits of infrastructure in developing nations. Over $340 billion was estimated as the amount loss to corruption in construction industry (America Society of Civil Engineers 2004) worldwide every year. This undermines the provision of infrastructure facilities (Sohail and Cavill 2008) and poses significant threats to developing nations' development. This paper investigates what causes corruption during the construction of infrastructure projects and what can be done to address it in developing nations. Corruption is a major factor that reduces growth and worsens poverty in developing nations (Wren-Lewis 2004), and it undermines it rate of development. With improvement in monitoring, transparency and accountability before (pre contract) and during construction works, the level of corruption can be reduced therefore, reducing the negative impact of corruption of general populace.

Keywords: construction, corruption, development, infrastructure, leakages.

INTRODUCTION

Construction industry all over the World has a reputation for corruption, misappropriation of funds, bribery, and money laundering. According to Transparency International (2011) corruption on construction projects damages the developed and developing world, resulting in projects which are needless, defective, and over-priced. This leads to poverty, loss of life and economic damage and underdevelopments, especially in developing nations. It also damages companies, resulting in tendering ambiguity, wasted tender expenses, increased project costs, economic damage, reduced project opportunities / extortion and blackmail criminal prosecutions, fines, blacklisting and reputational risk.

Development of a nation is largely depending on the provision of infrastructure services for the public. A well procured and maintained infrastructure makes the development of a nation to be rapid both economically and socially. However, it has been observed in the World over that infrastructure services (water, electricity, school,

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health, transport, solid waste, access road and paving, community building) provision are not enough and not well maintained, especially in developing nations.
Corruption is a major factor that reduces growth and worsens poverty in developing nations (Wren-Lewis 2010). Foreign investors are unwilling to invest in the resources and technology that are needed in developing countries to improve their domestic macroeconomic performance because of high levels of corruption (Mbaku 2007).

America Society of Civil Engineers (2005) stated that the cost of corruption in infrastructure provision is not only of high economic cost, but also a high human cost. The cost of corruption cannot be measured, since payment of bribes in most cases is not open nor recorded publicly (Transparency International 2010). Whilst Dreher and Herzfeld (2005) stated that over US $1 trillion is paid as bribes every year, out of which corruption in construction accounted for almost half (ASCE 2010), which shows that 50% of infrastructure allocations go to corruption (Anon, 2011) alone.

Research aim and objectives
This research aims to understand and research into how financial leakages in infrastructure provision can be eradicated, hence improving the quality and quantity of infrastructure services in developing countries (Nigeria).
The following objectives have been identified in pursuant to the aims of this research:

- Identify the factors that contribute to the lack of monitoring, accountability and transparency during the implementation and development of infrastructure projects or services in developing nations.
- Determine the main causes of corruption or why people are corrupt when providing infrastructure services.
- Establish the best way corruption can be reduced or eliminated during the construction processes.

Justification of the research
Provision of infrastructure is a major milestone in the development of a nation while developing countries still lag behind in infrastructure provision in the world over.

Developing nations have no good infrastructure provisions to show for their development due to corruption or financial leakages that eroded it implementation hence, the need to delve into the causes to assist in proffering solutions

Research methodology
Both Quantitative and Qualitative methods were adopted for this research due to the sensitivity and in order to be able to address the said objectives. Quantitative data was gathered through well-constructed questionnaire of which 81 was received and analysed out of 171 sent out through different means (on-line, postage, and hand-to-hand). Of all these, hand-to-hand is most successful due to lack of infrastructure (Electricity, internet) provision. On the other hand, qualitative data was gathered through interviewing 2 Quantity Surveyors, 3 Civil Engineers, 2 Architects and 2 Construction Managers with various years of experience in Construction and Infrastructure provision projects.

The evidence gathered from the qualitative (interviews) was analysis based on the similar responses from the nine interviewees. Whereas, quantitative data was analysis by finding the relative importance index (RII) because of the nature (likert) of the questions and also using mathematical (graph) method.

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INFRASTRUCTURE

Infrastructure has generally been recognised to be a main determinant of growth and productivity convergence in the entire world (Briceno-Garmendia, et al 2007). It is refers to by EIC (2006) as a necessary prerequisite for economic growth and good efficient use of a nation's resources. Provision of infrastructure services has direct impact on the investment, it creates employment opportunities, therefore, improving the living conditions of the affected population and reducing poverty.

An infrastructure provision apart from contributing to economic growth it is also a very important input to human development (Foster and Bricenco-Garmendia 2010), which in turn reduce poverty and inequality in any society. Certain infrastructures are investments tools that will help reduce poverty. Provision of infrastructure will allow low-income earners to devote more time to earn more income rather than spending such time on water collection or trekking long distance (Fox, 1994). Non availability of infrastructure like rail, power (electricity), water makes people spend more while they earn less.

CORRUPTION

Corruption is a major factor that reduces growth and worsens poverty in developing nations (Wren-Lewis, 2010). A huge loss is being incurred through corruption in infrastructure. About 5 to more than 20 per cent of the total cost of infrastructure services are lost to bribe payments, which is just part of economic damage from corruption all over world (Mumssen and Kenny, 2007). Kenny (2006) stated that stolen of electricity by customers in collusion with staffs accounted for as much as 20 to 30 per cent. Furthermore, the stolen of materials during construction reduced the benefits of the road to end users by an estimated $3.41, since building or construction work with insufficient material reduces its life span (Mumssen and Kenny, 2007).

Corruption in different stages of infrastructure delivery

Corruption is a very broad term which takes many forms and can be found in all stages of infrastructure project (see Table 1).

TABLE 1: Corruption in various stages of infrastructure delivery

Stage of service delivery	Examples
Project selection	• Corruption can negatively affect the selection of projects. For example, corruption can divert resources away from social sectors and toward major infrastructure projects. • Corruption may also encourage the selection of uneconomical projects because of opportunities for financial kickbacks and political patronage.
Planning stages	• Project used as vote winners/opportunities for personal gain not on basis of priority/availability of financial resources. • Planning in favour of high value infrastructure (white elephant projects) and against the interest of the poor. • Project requirements may be overstated or tailored to fit one specific bidder. • Over-investment in capital goods at the expense of GDP growth.
Inspection stages	• Weak oversight and supervision mechanisms have been created that would prevent detection of fraud and corruption. • Kick-backs can be given to persuade inspectors to turn a blind eye to slow implementation of projects, unfulfilled contract requirements, and

	other instances of malpractice.
Design	• Corrupt selection of consultants for feasibility studies, preparation of specifications/bid documents. • Over designed and overpriced projects to increase potential corrupt earnings during implementation. • Bribe for favourable environmental impact assessment/planning proposal/approval. • Project design has been manipulated to benefit particular suppliers, consultants, contractors, and other private parties. • The timing of the project has been altered to suit vested interests.
Bid and contract signing stage	• Political parties levy large rents on international businesses in return for government contracts. • Officials take percentages on government contracts. • Officials receive excessive "hospitality" from government contractors and benefits in kind. • Kickbacks for construction and supply contracts. • Lack of competitive/inequitable contract practices. • Inappropriate bidding procedures; excessively short bidding time or insufficient or inadequate advertising of tender. • Corrupt practice on the part of bidders (e.g. unjustified complaints, misleading bids). • Collusion among firms or between public officials and bidders. • Bid rigging in construction contracts can be facilitated by corrupt project managers and quantity surveyors, (people who are supposed to be policing contracts and making sure the clients get value for money) • Compensation payments included in the tender price: when two firms collude, and one prices self out of one of the job and receives a compensation payment from the other as a reward. • Cash-plus contracts enable unscrupulous firms to inflate the value of the contract • The entrance fee, for example a public authority agrees to give a private company the contract, provided that the company pays a fee. The company that pays the highest entrance fee wins the concession.
Construction	• Cutting corners, ignoring rules, by passing procedures • Payment for equipment, materials or services which were not supplied. • The provision of equipment or goods of lower then specified quality (typical examples include lesser cement or steel reinforcements). • Concealing substandard work. • Bribe the relevant official to certify that the work was done according to specification. • Unjustified complaints from contractors as a way to obtain unjustified contract price increases. • Duplication of payments, alteration of invoices, lack of supporting records, ineligible payments, over billing, misuse of funds (i.e. for purposes other than those aligned to project needs), misappropriation of discounts from suppliers/contractors, unauthorised payments etc. • Unauthorized use of project property. • Theft of materials, equipment or services. • Entrepreneurs and brokers that exist as 'fixers' facilitating relations between government and business players and negotiate the various administrative and legal steps.
Service delivery	• Ghost/absent workers. • Siphoning off supplies to market.

Maintenance and management stages	• Favouritism in hiring/promotions • Use of contacts/money to get better/faster service or to prevent delays. • Elite capture of infrastructure services. • Corruption in procurement of equipment and spare parts. • Withholding needed approval/signatures of gifts/favours. • Corruption increases costs meaning lack of resources for O&M. • Bribes to win O&M contracts/ personnel appointments. • Lower standard of construction creates need for expensive repair and maintenance.

Source: Sohail and Cavill, (2008), and Cavill and Sohail, (2007)

Factors that affect the quality of work during construction processes;
Various factors were attributed as the causal of poor delivery of construction work during execution processes. With regards to the respondent shown in figure 1 below, where '1' represent the most influential and '6' the least influential factor, it indicated that lack of proper monitoring and supervision is the *most influential* factor that affects the quality of work in construction works followed by substandard materials.

Factors responsible for lack of monitoring, accountability and transparency on construction projects;
After careful consideration average rating (see figure 2) it has been observed that 'selfish interest' is the most important factor with average rating of 1.35, followed by 'greediness' with the rating 1.46. Low or insufficient salary and uncared attitude were both rated 3rd and 4th with 1.86 and 1.95 respectively. Average rating calculation also revealed that 'lack of ability / insufficient of judiciary in punishing corrupt officials' and 'lack of awareness' were rated into 5th and 6th position with 2.22 and 2.27.

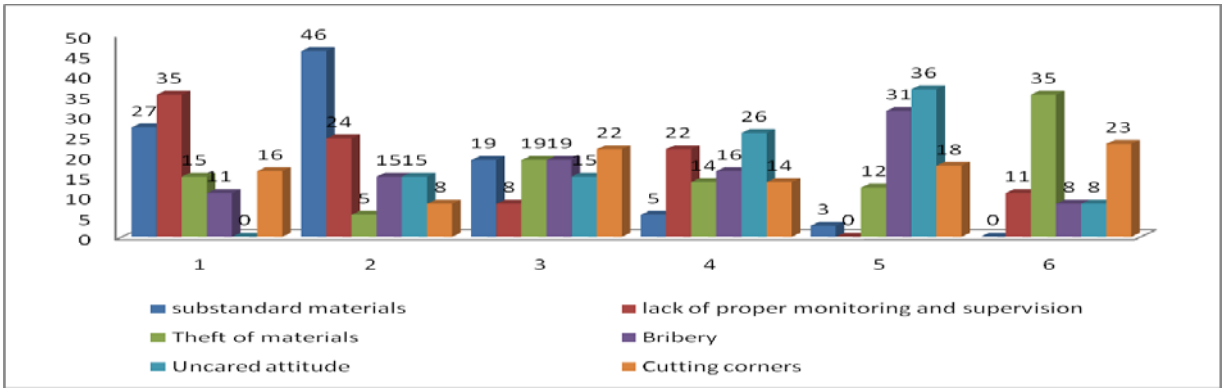

Figure 1: Factors that influence the quality of construction projects.

Proper accountability and what can be achieved to improve infrastructure provision;
From the survey conducted, table 3 shows that 92% of the respondents believed that if accountability is properly implemented, it will help improve the quality and quantity of infrastructure provision in developing countries (Nigeria) (49% indicated that is going to be very effective and 43% indicated that it can be effective). While negligible 3% indicated that is impossible in Nigeria system and the remaining 5% remained neutral.

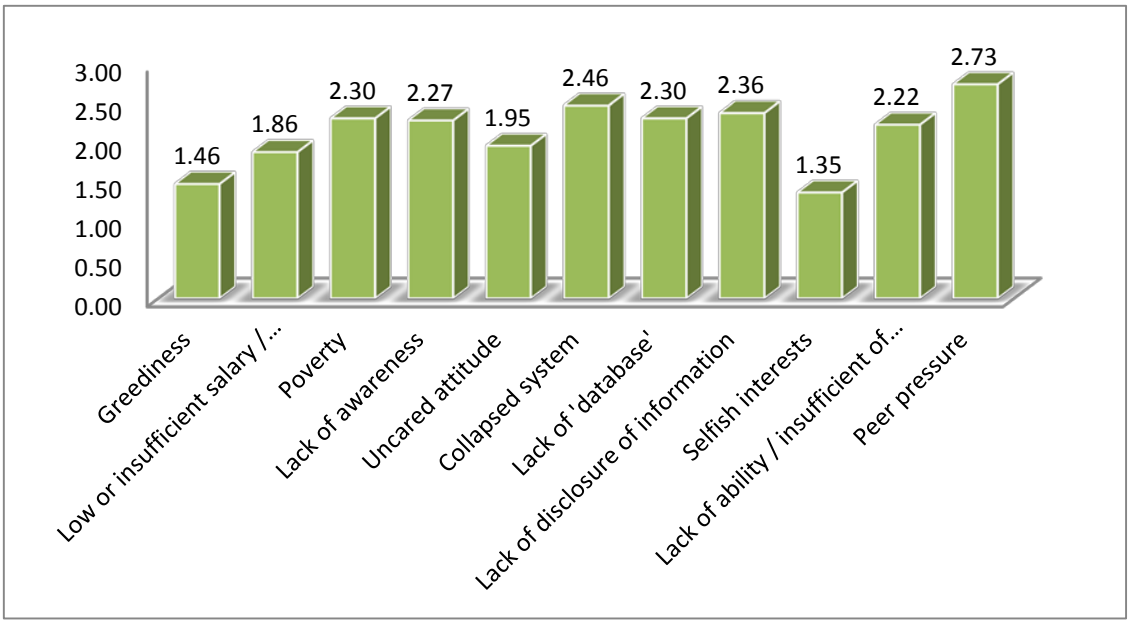

Figure 2: Causal of corruption during construction execution processes

Table 2: Effect of proper accountability

	%
Very effective	49
Effective	43
Neutral	5
Not effective	0
Not very effective	0
Impossible to predict	3

Monitoring

Questionnaires survey results show proper monitoring during construction processes will be *very effective* and *effective* with total 92% of respondents supporting the motion, while the remaining 8% went neutral.

Table 3: Proper monitoring during construction processes

	%
Very effective	70
Effective	22
Neutral	8
Not effective	0
Not very effective	0
Impossible to predict	0

Causes of corruption

From the interview conducted, it was gathered that the main causes of corruption is pressure from the government for not providing necessary infrastructures, starting from water, good road, electricity, good education, hospitals. These make people to be under pressure of looking for money to cater for *complex* needs.

Other similar causes identified are; government lack focus on what to provide, poor wages or salary, three of the respondents specifically made mentioned of lack of national identification system (cards) which made it possible for everyone in the country to be anonymous.

Lack of accountability, monitoring and transparency.
Accountability, monitoring and transparency has identified by Sohail and Cavil 2008, provide effectiveness of public officials or private organisation to perform to their maximum capacity, which resulted in providing value for money, instilling confidence in the government and being responsible to the communities as a whole or the whole country in general.
From the evidence gathered, it can be seen that proper monitoring by given relevant instruction, quality control and thorough supervision during construction processes will help improve the quality of work, reduce the amount of wastage and increase people's confidence in the government. Accountability and transparency of the officials involved in the construction processes are other important factors that were mentioned. If the supervising teams are accountable for their various actions, they will be serious and make sure that proper things are done.

CONCLUSION AND RECOMMENDATION

Some of the factors that ginger corruption during construction execution processes were identified and how it can be reduced or eliminated were obtained from the data. The following conclusion can be drawn from this research results:

- From the results, it can be seen that the factors responsible for lack of monitoring during construction project execution included selfish interest as believed by majority of the respondents. It was feasible that if proper monitoring, accountability and transparency can be put in place by certain means, the level of corruption will be reduced.
- Corruption is the main reason why developing countries are far behind in infrastructure provision despite the huge amount of money spent. Hence there is need to for the involvement of other stakeholders (users) during the planning activities, checking and removing unnecessary expenses before and during execution processes (value engineering), engagement of qualified contractors directly for project execution rather than encouraging nepotism, monitoring by qualified professionals as well as task forces, execution of relevant infrastructure projects rather than money generated infrastructure projects.

Corruption will be reduced or eliminated in construction projects if all stakeholders (inclusion of multi stakeholders in project execution) join hands in the development and implementation of effective anti-corruption programme which tackle both supply and demand sides of corruption.

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CASE STUDY: CONSTRUCTION COMPANIES AND THE SUCCESS OF THE RECONSTRUCTION PROCESS IN KOREA

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ABSTRACT

This study investigates the roles of construction companies during the reconstruction process of apartment buildings in Korea. The main actors in the reconstruction process include: the reconstruction association; the construction company; the buyers (association members and new buyers); and the local authority. There are two types of project participation for construction companies in the reconstruction process: the traditional contractor arrangement; and the turnkey base (design/build) contract. The results of the case study show that construction companies are critical to the success of reconstruction projects because of their performance guarantees for project financing and their brand names for sales of apartment units.

Keywords: apartment building, brand name, construction company, Korea, project finance, reconstruction

I.NTRODUCTION

From the 1970's, the Korean government's promotion of large-scale multiple family housing construction project was driven in response to ongoing national housing shortages. In the 1990's alone, the Korean government promoted two million housing units construction projects domestically. Since the 1990's, the multiple family housing buildings (mainly apartment buildings) built in the 1970's and 1980's had become

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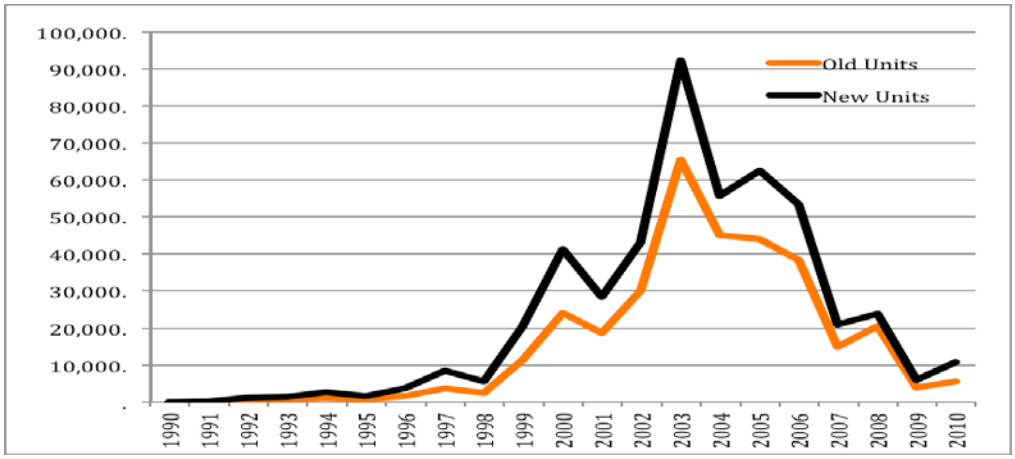
appreciably deteriorated. Consequently, demand for urban regeneration to improve the quality of old apartment buildings has increased. The enactment of the *Urban and Housing Environment Regeneration Act 2002* provided a turning point for urban consolidation and housing redevelopment/reconstruction projects in Korea. There were significant increases in the number of reconstructed housing units after 2002. Figure 1 shows the numbers of old and new housing units in reconstruction projects from 1990 to 2010 in Korea.

The main purpose of the housing redevelopment project is to remove run-down houses and to take steps to prevent the areas from further deterioration. The housing reconstruction project was also put in place to remove deteriorated apartment buildings and develop new apartment buildings. As the results, new high-rise apartment buildings were generally developed in those areas.

The aim of this study is to investigate the roles of construction companies during the reconstruction process of apartment buildings in Korea.

FIGURE 1: Number of Old and New Housing Units in Reconstruction Projects (Development Application approved)



Source: Ministry of Land, Transport and Marine Affairs (MLTM), Korea

RECONSTRUCTION PROCESS

The reconstruction process must be undertaken in accordance with the procedures in the existing laws. Existing owners of old apartment buildings voluntarily form a reconstruction association, then demolish deteriorated existing apartment buildings and construct new apartment buildings jointly with construction company on the site where the old buildings were located. The *Urban and Housing Environment Regeneration Act 2002* defines a deteriorated housing building for redevelopment/reconstruction as: (i) a structure that is extremely damaged or partly collapsed whereby the potential for total collapse is high or a potential safety hazard; (ii) a building that is located in very poor

housing environment compared to the neighborhood land use condition; (iii) there is a considerable increase in the expected utility if demolished and redeveloped as compared to undertaking excessive repairs and maintenance costs; and (iv) 20 years have passed since initial construction and needs to be demolished due to poor urban landscape, structural defects by aging and deficient construction.

The Table 1 shows typical procedures of the redevelopment/reconstruction of apartment buildings. A District Office establishes a ten-year 'Urban Housing Regeneration Plan' and reviews it every five years. Based on the Urban Housing Regeneration Plan, a deteriorated site area could be designated as 'Urban Regeneration Zone'. A group of existing land and housing owners within Urban Regeneration Zone can organize a redevelopment promotion committee, while a group of existing owners of old apartment buildings can organize a reconstruction promotion committee. The aim of the committees is to persuade existing owners to consent to the redevelopment/reconstruction process based on the preliminary cost-benefit analysis or feasibility analysis. The reconstruction promotion committee must submit a 'Building Safety Inspection Application' to the District Office. The agencies assigned by the District Office thoroughly inspect any physical deterioration, defects and damage to structures and submits inspection reports to the District Office.

TABLE 1: Redevelopment/ Reconstruction Process

	Steps	**Details**
1	Urban/ Housing Regeneration Plan	Prepared and approved by Metropolitan City Mayor or approved by Regional Governor (prepared by City Mayor)
2	Urban Regeneration Zone	Prepared by District Office and approved by Metropolitan City Mayor. For **redevelopment** project
3	Promotion Committee	Approval with more than half of the existing ownerships
4	Building Safety Inspection	For **reconstruction** project only
5	Establishing of Association	- **Redevelopment:** approval with more than 3/4 of total ownerships and more than 1/2 of land ownerships - **Reconstruction:** approval with more than 3/4 of total ownerships and more that 2/3 ownerships in each building
6	Registration of Association	Approved by District Office Project plan and Development Application
7	Development Application Approval	Approved by District Office
8	Selection of Construction Company	Tender, Presentation by the construction companies, Selected by association general meeting
9	Ownership Control and Transfer Scheme	Finalization of Credit portion Application of purchase by the association members Approved by association general meeting

10	Construction/ Sales	Association members moving-out Demolition and construction Public sale start after 80% of structure construction
11	Completion/ Moving-in	Completion of construction and move-in
12	Resolving Association	Resolving association general meeting

Source: *Urban Regeneration Act* 2002

Existing owners must vote to decide whether they will pursue any reconstruction process. In order for reconstruction to be possible, three-quarters of the existing owners in the complex, and two-thirds of existing owners in each building, must vote in favor of any reconstruction proposal. If the proposal is consented to in the association general meeting, a reconstruction association can be established. A 'Disposal Claim' would be issued to existing owners who do not want to participate in the reconstruction project. If the old apartment buildings pass (negatively) the Building Safety Inspection test, the District Office reviews the appropriateness of reconstruction plan and the association members' qualifications (only the existing owners of housing units can be members) and officially approves the reconstruction association (Lee *et al.* 2005).

The association selects a construction company or companies (if it is a large-scale development), and the association and the construction company submit a development application to the District Office, and obtains an approval for demolition and construction from the District Office. The association and the construction company finalize the 'Ownership Control and Transfer Scheme' that the values (the 'Credit Portion') of existing association members' old housing units are decided. During the construction period, existing owners must move out from the complex. Most of them find their temporary housing in the neighborhood community as rental tenants. The construction company fully or partly subsidizes any rental costs based on the size of old housing unit. If there are any additional units available in new housing buildings other than existing owners as the result of increased floor space ratio (FSR), those additional units could be sold. The income generated from the sales would normally be the main source of payments to the construction company. After the construction is completed, existing owners and new owners move into the new apartments, at which time the reconstruction association is dissolved.

A reconstruction association can determine the number of new housing units and their sizes if it satisfies certain regulated floor space ratio (FSR) constraints, but each existing owner is allowed to obtain only one new housing unit after reconstruction. However, the number of housing units developed in a complex through reconstruction is normally greater than the existing number of units since the new project has a higher FSR than existing buildings (e.g., high rise apartment buildings with more and larger size units).

This high rise and high density building is a result of combinations of an increased FSR by the Government, the profit-maximizing behavior of the existing units owners, and generally sufficient demand for housing units in Korea.
Through the reconstruction process, it is found that the main actors in the reconstruction process are: (i) the reconstruction association, (ii) the construction company, (iii) the buyers (association members and new buyers); and (iv) the local authority.

SELECTION OF CONSTRUCTION COMPANY

The selection of a construction company is the most important step for a successful reconstruction project. The construction company not only provides the construction services based on the contract, but also acts as a developer and a lender for the project. The construction company and the reconstruction association are working as partners in the reconstruction project. Whilst the construction company is virtually always a strong organization in terms of knowledge and experience, the reconstruction association is likely to be a relative weak organization. For this reason, the construction company normally manages the reconstruction project.

In the early stage of the reconstruction process, the reconstruction association only has the old run-down apartment buildings as a financial asset. However, there will be some revenues from sales of additional new units and retail areas, which is likely to be the main source of funds to pay to the construction company. The construction company is not only undertaking the construction works, but also supports the operational expenses of the association.

There are two types of contract between the association and the construction company depending on how the parties share the development profits. The contract types include: (i) traditional contractor arrangement; and (ii) turnkey base (design/build) contract. See Table 2 below.

TABLE 2: Contract Methods with Construction Company

	Traditional Contract	**Turnkey Base Contract**
Definition	Total contract amounts for construction works is fixed when the contract is made. (Traditional contract method)	The contractor is responsible for all necessary costs for the project. The Credit Portion of the existing owners is fixed when the contract is made.
Scope of work	- Association: responsible for indirect construction costs, other costs, fees, and taxes - Construction company: responsible for direct construction costs	- Association: responsible for members' taxes and fees - Construction company: responsible for all project costs including construction costs
Escalation	Escalation possible based on	No escalation and change possible

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and change	inflation Change possible based on revision of scope and design	after contract
Members' credit portion	Members' Credit Portion can be changed according to the project revision.	As the Credit Portion is fixed at the contract, there is no change after.
Project closing	Development profit or loss belongs to the association (100%)	Development profit less fixed members' Credit Portion and additional construction costs to the construction company

Source: Ministry of Construction and Transportation (2000) Reconstruction Process Manual

In general, the traditional contract arrangement has been the dominant contract method for reconstruction projects. However, since 1993, many reconstruction projects were commenced under Government regulation and so the turnkey (design and build) contract has been the preferred contract arrangement. However, since the Asian Financial Crisis in 1998, the construction companies seem to have preferred the traditional contract method.

The factors considered by the reconstruction association in selecting a construction are (a) the brand power of the company; (b) the debt ratio of the company; (c) total contact amounts of the company in previous year; and (d) the bidding price for the project (Kim 2009). It appears that the characteristics of the construction company, itself, are more important to the reconstruction association than the project tender price in selecting a construction company.

The first priority factor is brand power of apartment name from the construction company. In 1998 the brand name of an apartment building was introduce in Korean housing market (Shin 2009). Since then, the brand naming became very popular in apartment buildings. A housing buyer considers the trustful brand name as one of the most important factors in decision-making process (Ji 2005). As the location of reconstruction project is fixed, the transportation and surrounding environment cannot be changed, which are important factors in decision-making of purchasing an apartment unit. Hence, the association members put the brand power of the construction company as the most important factor to select a construction company, which attract high demands for public sales, and increase the values of their units at the disposal stage.

The debt ratio and the size of the construction company are important because of its key role in the real estate development project finance system in Korea. The construction company ought to submit a completion guarantee in which it promises to timely finish the object buildings by the completion date in the contract. Moreover, the construction company must serve a joint liability on guarantee with the association (borrower). Charging construction company with heavy burdens of Cash Deficit Support (CDS), completion guarantee and debt obligation, a lender can deal a risky credit loan for the

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borrower (association), which has no hard asset security and is uncertain about the sufficiency of repayment resource in maturity (Kim & Sakong, 2009).

CASE STUDY

'Project A' was a reconstruction project in the southern part of Seoul, Korea. There were 2,400 housing units in old five-storey buildings before reconstruction. The new development included 3,410 housing units in 44 new apartment buildings (29 storey with two basement levels), and other welfare facilities. The Development Application was approved in October 2004, and the Ownership Control and Transfer Scheme was approved in February 2005. The construction was commenced in April 2006 and was completed in March 2009. See Table 3 below.

As the FSR was increased from 80% to 269%, the old 2,400 housing units with average 64.7 m^2 per unit were demolished and 3,140 housing units, with average 166.9 m^2 per unit, were developed. The association members purchased 2,377 units, and among the remaining 1,033 units, 593 units were sold to the public with 440 units assigned as public rental housing. The Credit Portion of the existing owners was finalizes at USD 1,239 million in the Ownership Control and Transfer Scheme. Total costs of the project were estimated as USD 822 million including direct construction cost of USD 504 million.

TABLE 3: Summary of the Project A

	Description
Developer	BJ3 Reconstruction Association
Construction	OO Construction Co Ltd
Location	Seocho-gu, Seoul Korea
Zone	General Residential (type 1), Apartment Zone
Site area	194,118 m^2
Old Buildings	FSR: 80% Total building area (above ground): 155,295 m^2 2,400 housing units
New Buildings	FSR: 269% Total building area (above ground): 524,086 m^2 44 apartment buildings (2 basement levels and 29 storey) 3,140 housing units and other welfare facilities
Credit Portion	194,118 m^2 x \$6,385 per m^2 = U\$1,239.4 million
Costs	Total costs: U\$822 million Construction: \$504 million Design, financing, and others: \$318 million
Revenue	Total revenue: U\$ 877.5 million Members' contribution: \$372.6 million General public sales: \$425.9 million Rental housing compensation: \$79 million (value: \$226.5 mil)

Development Profit	U$1,345.1 million ($560,500 per unit) (Total value – Credit Portion – Total costs) Total value: $3,406.5 million (524,086 m^2 x $6, 500 per m^2)

Source: Jung (2006), Kim (2006) (U$1 = KRW1,164)

The association members' contribution for purchasing was estimated as USD 372.6 million, and the revenue incomes from general public sales were initially estimated as USD $652.4 million. However, as the Government introduced the compulsory rental housing inclusion for reconstruction project in March 2006, 10% of the additional building areas were developed as public rental housing – the regulation is 25% of additional building areas. As the Development Approval of the project was approved by March 2006, the project was allowed to supply 10% of additional building areas as rental housing units. The rental housing compensation from the Government was USD 79 million instead of the worth USD 226.5 million. The total incomes of the project were estimated as USD 877.5 million, which provided USD 55.5 million as profit for the development.

The initial development profit was estimated as USD 1,345 million – an average of USD 560,400 per existing owner. The introduction of compulsory rental housing created a significant setback in development profit. The value of new housing unit was initially estimated as USD 6,500 per m^2. However, the new housing value was estimated as USD 9,100 per m^2 when the project was completed in 2009.

OO Construction Co Ltd is a part of a large conglomerate and viewed as having a top brand name and sound credit rating (A2). It could provide not only superior construction service for the project, but also a necessary guarantee for project finance. As the contract method was a turnkey base (design/build), the construction company would be responsible most of costs and profits from the project variation once the Credit Portions of the association members were fixed. The construction company provided a completion guarantee and a joint liability with the association to the lender for project finance.

As this reconstruction project was located at one of the best residential areas in Seoul, and is close to transportation facilities, there was expected to be very high demand for public sales. The reconstruction project was approved the Ownership Control and Transfer Scheme on February 2005, one year before the Government's Reconstruction Control Plan on March 2006, which setup the high bars for new reconstruction projects (Jung 2006). Hence, this project is very attractive to the existing owners as well as general public. However, the lender requested the construction company to serve the joint liability on guarantee with the association, notwithstanding that the construction company (with a sound credit rating) provided the completion guarantee.

CONCLUSION

There are four main actors in reconstruction project: (i) the reconstruction association; (ii) the construction company; (iii) the buyers (association members and new buyers); and (iv) the local authority. To select a construction company, a reconstruction association considers (in descending importance): (i) the brand power of the company; (ii) the debt ratio of the company; (iii) size of the company; and (iv) bidding price for the project construction to be the key factors. The brand power of the construction company is the most important factor for sales of reconstructed apartment units because the location of the project cannot be changed. The debt ratio and size of the construction company are also very important for the project success because a lender normally requires the construction company to provide a completion guarantee and a joint liability on guarantee with the association (borrower) even though the reconstruction project is seen to be very profitable. Hence, the selection of a construction company is the critical step for the successful reconstruction process in Korea.

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FORECASTING SUPPLY OF COMMERICAL OFFICE BUILDINGS USING POLYNOMIAL DISTRIBUTED LAG MODEL

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ABSTRACT

Forecasting the supply of commercial office buildings is critical for the economic development. Using the data from Hong Kong, the major factors influencing the supply of commercial office buildings such as gross domestic product, property prices, vacancy rates, interest rate are examined. Unlike the investment in financial assets, commercial office building developments are characterized by a time lag from the decision to build until their completion. The lead-lag structure of these major factors in determining the supply of office buildings is identified. Using the technique of polynomial distributed lag, the lead-lag model is simulated, and provides a reliable forecast on the supply of office buildings. Considering the prevailing shortage of commercial office buildings as result of economic growth in Asia, the forecasts derived from the model are deemed to be useful for economists and property analysts to facilitate their investment decision-making in the future.

Keywords: economic development, forecast, distributed lag model, investment decisions, office building,

INTRODUCTION

The accuracy of forecasting techniques to predict the supply of the office buildings (in terms of meter squares) has long been critical for the development of an economy. Most construction industries around the world are portrayed as high unstable activities and even being volatile than other industries (Rosenfeld and Warazawski, 1993; Goh, 2000; Song and Liu, 2007; Sing *et al*, 2012). Its cyclical nature in output has posed many problems such as the suppression on economic development. In addressing the need to accurately predict the completion of buildings; several models have been propagated in respect to different types of property construction (Nicholson and Tebbutt, 1979, Puri and Lierop, 1998; Kling and McCue, 1991; Giussani andTsolacos, 1994; Tsolacos, 1998). However, there have been few empirical studies on modeling

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the supply of office buildings using the economic indicators as well as a lead-lag relationship between them. Against this contextual backdrop, this paper develops the distributed lag model to provide an accurate prediction on the construction output of office buildings in Hong Kong.

Forecasting is a process to portray the uncertain future and plays an important role in the process of making a rational decision regarding the effective utilization of the various resources. Makridakis (1983) and Makridakis*et al.* (2009) suggested that there is always a lag time between the impending event and occurrence of that event. To determine when an event will occur or a need will arise; forecasting can make a statement about the future on the presumptions that the future will be like the past. However, the forecasting process always involved complex procedures and consideration on different factors. In order to provide accurate forecasting toward the future, there are several techniques that have been developed and which can be mainly divided into three broad categories. They are (a) Multiple regression model; (b) Granger and Causality Analysis and (c) Vector Autoregression model (VAR).

(a) Multiple regression modeling

Multiple regression modeling is applied to establish the causal-effect relationship between one dependent variables in terms of one or more other independent variables through the examination of the past data series. The forecast value of independent variable would then be projected through this relationship. The general form of the multiple regression modeling is shown in Eq.[1].

$$y_i = b_o + b_1 x_{1i} + b_2 x_{2i} + ... + b_k x_{ki} + \varepsilon_i \quad \text{.....Eq.[1]}$$

where:

y_i = ith observation of the dependent variable, y

x_{ji} = ith observation of the j th independent variable

b_o = intercept term with Y-axis

b_j = regression coefficient for each of the independent variables (i.e. $j=1,2,3...$)

ε_i = the residual (or error term) for the ith observation

Several authors have applied this technique in forecasting construction variables such as price, demand and construction output. Puri and Lierop (1988) first applied this technique in examining the housing starts in U.S. and a number of regression equations are integrated into economical model. The key variables examined in their model are related to mortgage commitment, flow of deposits and interest rate, etc. In addition, Tang *et al.* (1990) have applied the regression model in predicting the construction demand in Thailand and Singapore construction industry respectively.

(b) Granger Causality Relations

In Granger Causality relations, it is assumed that the relevant universe of information consists only of time series, $X_1(t)$ and $X_2(t)$, X_1 is said to Granger-cause X_2 if the

lagged values of X_1 can provide better prediction on the future values of X_2 than using only the lagged values of X_2.

$$X_2(t) = \sum a_j X_2(t-j) + \sum b_j X_1(t-j) + \alpha \quad \text{.....Eq.[2]}$$

where:

X_1 = stationary variables to explain the variable X_2

X_2 = variables to be explained

a_j, b_j, α = constant

and test the hypothesis:

$$H_0 : b_j = 0, j = 1,..., j \quad \text{.....Eq.[3]}$$

If the t-statistics is statistically significant, it can be concluded that H_0 should be rejected and X_1 Granger-causes X_2.

Meanwhile, Tse and Ganesan (1997) applied the same theory in identifying the relationship of construction flow and GDP in Hong Kong. Lean (2001) also developed another model based on Granger Causality Test in identifying the relationship of the construction flow and other outputs of other sectors within the Singapore economy.

(c) Vector Autoregression (VAR) model

The VAR model is extension of the Granger-Causality relation, which contains more than one variable under study. The model is designed to forecast the value of variable based on its own lags and the lags of all the other variables in the model.The VAR model has been used to model new work orders for industrial buildings and retail development (Kling and McCue, 1991; Tsolacos, 1998). Kling and McCue (1991) applied a VAR model to examine the relationship between the industrial construction and the macro-economy. Similarly, Tsolacos (1998) developed a VAR model based on changes in real consumer expenditure and real retail returns.

DATA COLLECTION

The data used in this study includes the available quarterly time series for completion of office building (in term of squared meter), gross domestic product, property price index and vacancy rate of office buildings from January (Q1) 1993 to December (Q4) 2010. Those statistics are extracted from the government publications such as the *Property Review* issued by Rate and Valuation Department, economic statistics from Census and Statistics Department of Hong Kong government. To prevent any random short-term fluctuations that may have been taken into account, a centered four-quarter moving averages technique would be employed for estimating the trend of the raw

data in the presence of quarterly seasonality. Eq.[4]is applied for estimating the trend of the raw data in the presence of quarterly seasonality.

$$\widehat{y}_i = \frac{y_{i+2} \cdot 1/2 + y_{i+1} + y_i + y_{i-1} + y_{i-2} \cdot 1/2}{4} \quad \text{.....Eq.[4]}$$

MODELING ON THE SUPPLY OF OFFICE BUILDINGS

To forecast the supply of office buildings (in terms of meter squares), a polynomial distributed lag model is developed using EViews 7® for Window 7. The proposed model is distinct from previous studies, as it is utilize a lead-lag structure of economics related, the concept of autoregression. To identify the influence of those selected variables, the Granger-Causality and Graphical comparisons are used to identify their correlation. Based on the nominative literature review, the selected variables are (a) completion of office building in previous years, s_{t-i} (b) Business cycle in terms of gross domestic profit, GDP_{t-i}, (c) vacancy rate, vr_{t-i} and (d) property price index, ppi_{t-i}.

The concept of the Granger-Causality test is applied to determine out the statistical lead-lag relationship between the projected construction output and economics variables. To conduct the Granger-Causality Test, the time-series should be stationary (Zhou, 1996; Studenmund, 2001).A stationary time-series properties are constant over time (i.e constant variance), without trend and no periodic fluctuation. Two methods can be used to determine if a time series data is non-stationary. The simplest method is to visually examine the pattern of the dataset to determine if there is any exponential growth. A more scientific approach however is the application of the Augmented Dickey-Fuller (ADF) test. The null hypothesis for the ADF states a unit root or an underlying process is non-stationary exists. The ADF model is defined as:

$$yt = c + dt + ay_{t-1} + b_1 \Delta y_{t-1} + b_2 \Delta y_{t-2} + \ldots + b_p \Delta y_{t-p} + e(t) \quad \text{.....Eq.[5]}$$

and run a one-sides *t*-test on the hypothesis that $a = 1$

$$H_0 : a = 1$$
$$H_1 : a < 0$$

To illustrate the procedure to determine if a time series is stationary, Figure 1 provides plots of the quarterly supply of office buildings at Hong Kong used in the proposed model. It demonstrates a notable pattern of movement during the 1993 to 2010 period and the likelihood that non-stationary may exist. The non-stationary can be removed by the first differencing variable (Lutkepohl, 1999). In this model, the time series data has been transformed into the rate of change in supply of office buildings for providing stationary properties. The datasets used to formulate the forecast model have demonstrated that they are in stationarity term, which is the basic

requirement for applying the Granger-Causality test. In addition, the results of Granger-Causality test indicates that (a) supply of office building in previous years, s_{t-1}, (b) Gross Domestic Product, GDP_{t-i}, (c) vacancy rate, vr_{t-i} and (d) property price index, ppi_{t-I} are both significantly influence a change in supply of office building.

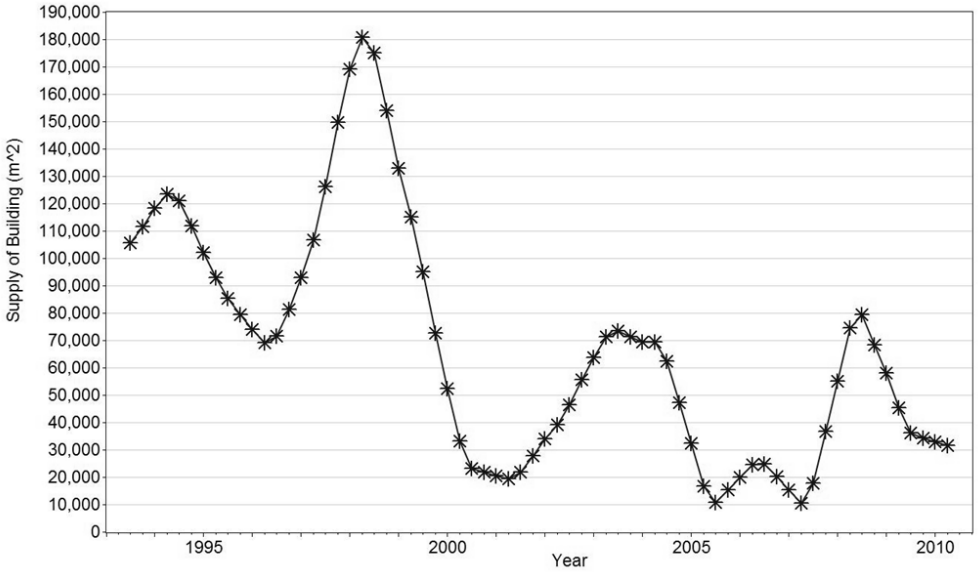

Figure 2 Time plot of quarterly office buildings at Hong Kong, 1993-2010

With the Granger-Causality test, it has to provide statistical evidence on the correlation between a change in supply and selected economic variables. The next step is to apply graphic comparison method for comparing supply of office building with key variables and to identify their lag structure. For example, in Figure 3, it is observed that the curves in the figures demonstrate a correlation between supply of office buildings and business cycle (GDP) and the lags for the period commencing 1993 were 4 to 8 quarters.

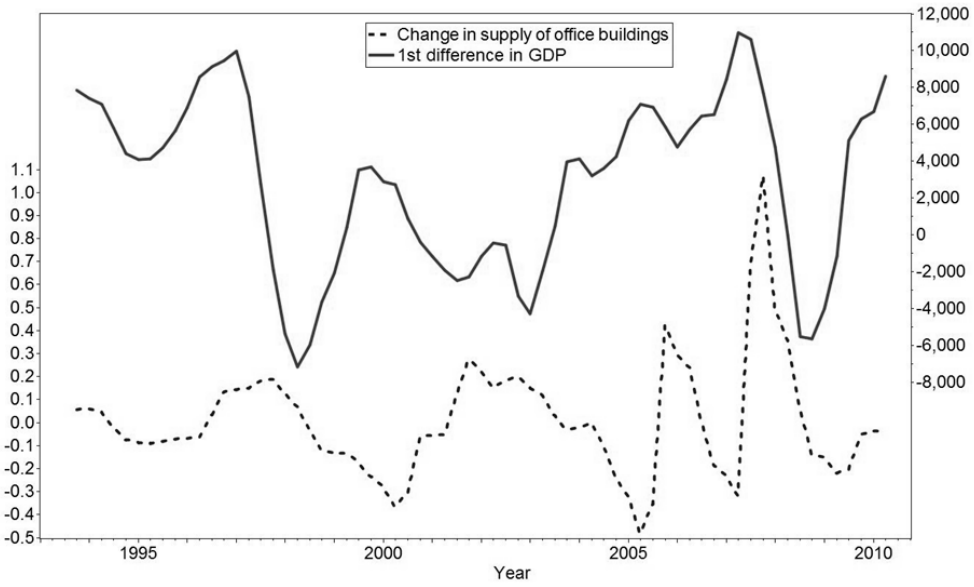

Figure 3 Supply of office buildings verse 1st difference in GDP at Hong Kong

As the lagged structure related for the key economics determinants have been identified in graph method. Using Eview7®, the forecast model for supply of office buildings in the current period is a function of lagged change in (a) business cycle in terms of GDP, (b) property price index, (c) vacancy rate and (d) supply of offices buildings in previous quarters. The equation for this forecasting takes the following form:

$$\Delta fso_t' = \sum_{p=i}^{j} \gamma_{1,p} \cdot \Delta so_{t-p}' + \sum_{p=k}^{l} \gamma_{2,p} \cdot \Delta GDP_{t-p} + \gamma_3 \cdot \Delta PPI_{t-q} + \gamma_4 \cdot vr_{t-r} + \varepsilon_t \quad \text{.....Eq.[6]}$$

Where $\Delta fso_t'$ is the forecast percentage change in supply of office, Δso is change in supply of office building, ΔGDP is change in gross domestic product, ΔPPI is change in property price index, vr is vacancy rate, p, q, r represented the lagged period, $\gamma's$ is constant parameter and ε_t is a random disturbance term.

Under the 95% confidence level of *t*-test, it is found that changes in *GDP* lagged five and six quarters (approx. to 1.5 years), change in supply of office buildings lagged one and two quarters, *change in vacancy rate* lagged six quarters and change in *property price index* lagged eight quarters which exerted the most significant influences on the forecast supply of building with *t+1*. In addition, the *R*-squared of the model is 0.68, which suggests that nearly 70% of the variation in construction output can be explained by this model. The predicted and the actual values are plotted in Figure 4.

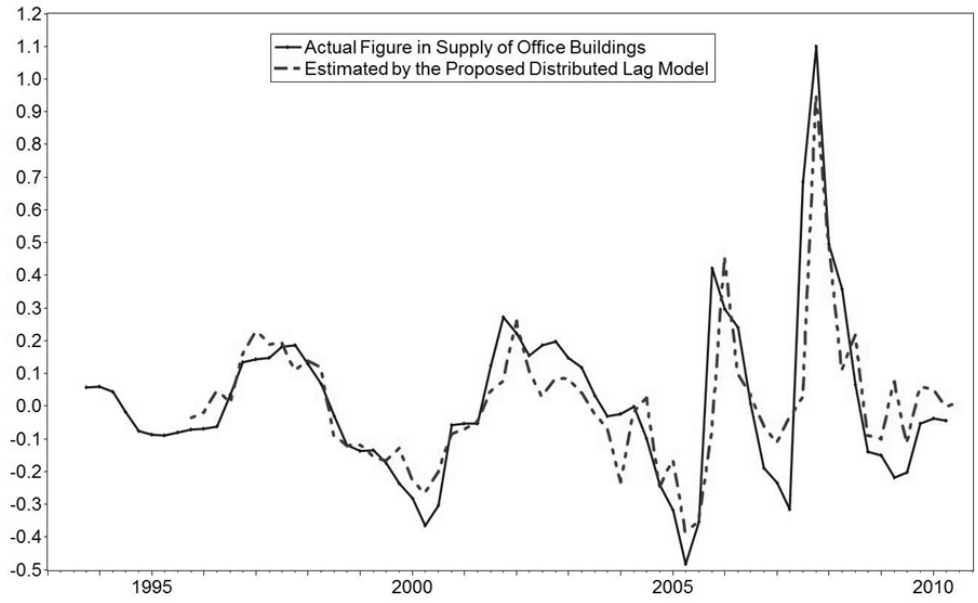

Figure 4 Actual and fitted value by proposed model on forecasting supply change in office buildings at Hong Kong

CONCLUSIONS

The distributed lag model presented in this paper has applied the concept of Granger causality and graphical method to identify the lagged structure between the economic variables and future supply of office building. Unlike the models prorogated in the literature review, four economic related variables were used to forecast supply in terms of squared meter: (a) business cycle in terms of gross domestic profit, (b) property price index, (c) vacancy rate and (d) lead-lag relationship of the office supply in previous quarters. In formulating the model, the quarterly time series were tested using Augmented Dickey-Fuller (ADF) test to ensure they are both stationarities and followed by Granger Causality test to study their relationship with the supply of office buildings. A consistent lag structure was then established through the application of graphic comparison method. With this in mind, a distributed lag model was developed to capture the long-term trend and turning points and R-square of 0.68 was derived. This provide a powerful tools for investors and policy makers on visualizing future supply of office buildings and make any necessary adjustment to their investment and policy strategies.

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RESIDENTIAL PROPERTIES FOR GRAVES: A TEST OF THE EFFICIENCY OF PLANNING LAW.

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ABSTRACT.

Land is an essential natural resource having numerous competing alternative uses which necessitate definition of potential uses within the ambit of legal framework to enhance compatibility and sustainable development. Basically, the extent of compatibility of land uses on residential real estate in urban areas is a measure of the performance index of the property law and its regulatory structure. Therefore, this paper seeks to uncover the causes of inefficiencies of Nigeria planning laws to prohibit indiscriminate location of graves on residential properties. It explores the Nigerian Urban Regional Planning law with a focus on development control paradigm and its specific ability to prohibit graves on residential properties in Akure. Lastly it examines the effects of the emerging negative externality on property value and sustainable real estate development in the case study. The paper suggests a review of development control laws and re-engineering of its' enforcement strategy with a particular focus on uniform interpretation of planning law on all residential land.

Keywords: grave, land, law, planning, residential.

INTRODUCTION

The provision of three basic necessities of life "food, clothing and shelter" are all subject to availability of land in qualitative and quantitative context. Therefore, given its status as the base of all human activities, it could be inferred that the demand for land ranked the highest of all commodities in the world. The importance of land cut across socio-economic and cultural divide. It is socially seen as a measure of wealth and social status especially in Africa and other developing nations where private land ownership is rife. As an economic good, its investment value is highly attractive as it provides hedge against inflation where many other investments fail during economic recession. Its' ability to maintain economic value in real terms have made it veritable investment asset opportunity. However, potential appreciation in value over time depends on the influence of individuals' land use decisions as well as efficiency of planning laws and development control. Generally, uncontrolled land use often generates negative externalities which culminate in reduction of value. Considering the potential impact of individual landlord's decision, it is globally evident that no government is indifferent to the utilisation of land within its territory. There are huge global concerns to ensure sustainability and prevent diminution in land's potential

ability to meet the needs of future generation. First major attempt at alleviating this concern is traceable to the "city beautiful movement" led by Ebenezer Howard in the 19th century. The ideal of his concept was to develop a residential district which transcends mere shelter surrounded by conflicting land uses. His works and other studies which are consistent with ordering of land uses provided a global take-up point for urban planning and land use control. Contemporary development in urban planning presumes and strongly advocates residential land use development that considers quality human environment and coexist with it. This is to be achieved through laws and development control which seek to ensure development of residential land within the context of socio-economic satisfaction. To a commendable degree, it is seen that this strategy have worked with appreciable result in the western world to prevent conflicting land uses in the cities. Conversely, the situation in the developing world cities is completely at variance. According to a Senior World Bank Official in Bell (1999), the state of land use in Africa suggests that the continent is at the brink of ecological collapse. With this report, the risk factor to real estate investment (land and residential properties) is on the increase in Nigeria and other developing nations bedevilled by conflicting land use. In specific terms, a particular problem of return and rental value on private residential properties in Nigeria is the threat from the escalating number of graves on residential properties. This can be seen as a structural problem of the land market which could be curtailed by efficient planning laws to prevent; reduction in property value, high vacancy rate, high illiquidity of an illiquid asset and stigmatisation. Therefore, the need to salvage residential land becomes ecologically imperative to maintain high level of housing ideal and aesthetically pleasing residential land. This is further strengthened by socio-cultural complexities and religion inclination in a socially diverse human society where cremation and other methods of disposing corpse are forbidden. Consequently, this study critically appraises Nigerian urban planning and development control law with a view to assessing its efficacy toward prohibiting graves on residential properties. The paper is structured into six different sections. Section two examines the use of residential land for grave as well as ownership of cemeteries in the study area. The third section reviews the position planning law concerning location of graves on residential properties. Also, it provides some commentaries on land market and its regulatory framework. The next section gives brief information on the study area and the research methodology. Section five offers discussion on the inefficiencies of planning law. The last section discusses the summary of argument and recommendations.

Land Use for Graves on Residential Property's Land in Nigeria

The growing numbers of graves on streets in many Nigerian cities pose great challenge to their future sustainability. The character of most streets are changing, it is now common to find slogans like; "Rest in Peace (R.I.P), Adieu Papa, the Soul of the Faithful Rest Here" and others on residential properties. After burial services, a statement like interment follows immediately in the deceased residence is common. Also, Medical experts discovered that the recent outbreak of Lasa fever epidemic in Ose Local Government Area and other urban centres established a nexus with graves in residential real estate. The chief vector of this disease 'Rat' burrows into graves of infected corpses and comes out to spread the malady by feeding on domestic foodstuffs.

Presently, cemeteries land is mainly held by established churches, mosques and the

local governments. Accessibility to churches' graveyards is mainly by membership status and the majority of them are filled up. There are also few privately owned cemeteries in some cities like Lagos and Ibadan. However, they are accessible to the rich who can afford the price. Government cemeteries are usually very large but unkempt and not secured. There is evidence of exhumation and mutilated bodies possibly for ritual purposes, perhaps one of the reasons for their low usage.

Observation reveals that graves are a common sight on streets; however the phenomenon does not extend to residential properties on public residential estate (government residential area). This situation leaves the city to a paradoxical correlation of two cities in one; where a part of the city shows marked evidence of development control while the other part is perceived to be developing in a separate uncontrolled land market. The government residential area "an offshoot of the formal land market" is seen as a market for the elite. Private residential areas are products of informal land market. They are seen as home for the low income earners and the commoners. The informal land market is largely unregulated and remains the surest means of accessing land; hence the high level of vulnerability of its use for graves. Observation from neighbouring countries such as Ghana, Togo, Congo, Senegal, Cameroun and Republic of Benin shows that this problem is a perennial land use challenge in virtually all African countries. This and other unwholesome land use perhaps have affected available usable per capital land. This assertion is further strengthened by Wit and Verheye (2007), they noted a sharp decline in Africa per capita available usable land, as record shows it nose-dived from 0.62ha in 1965 to mere 0.26ha in 1995. A decline was also noted in the available world's per capita usable land; the record shows a sharp drop from 0.39b ha in 1961 to 0.27 ha in the 1990s. Evidently, there are numerous marked evidences suggesting that unregulated human interference on residential land portends great danger to urban development in Nigeria. Consequently, the need to prioritise residential land use for optimum satisfaction unimpaired by graves becomes imperative.

Land Use Policy Framework; an Overview of Nigerian Urban and Regional Planning law

Land law and development control policies provide clear cut statements on the manner required for utilisation of land within urban areas in any country. Specifically, laws are a policy framework that ensures the use of land in an organized fashion. It helps to protect the maximum social and economic benefits of the present and future generations of land users. The Nigerian urban and regional planning law is the basis of all urban development and planning law in Nigeria. Following the provision of the Nigerian Urban and Regional Planning Act cap No.88 of 1992, each tier of government has responsibilities for exercising physical planning within the framework of the national physical development plan to ensure consistency in physical development at all levels of planning in the country. In order to achieve efficiency, equity and sustainability, the policy attempts to match different land uses with the greatest benefit at the least cost. This was to be achieved through developing national physical development plans at the Federal, State and Local government by establishing and maintaining namely;

(a) National Urban and Regional Planning Commission (Federal Commission).
(b) State Urban and Regional Planning in each state of the Federation (State Board).

(c) A Local Planning Authority in each Local government of the Federation (Local Authority).

The law mandated the Federal Commission, State Board and Local Authority to establish development control department. The development control department is a multidisciplinary department charged with the responsibilities of controlling developments and the implementation of physical development plans. The various development control departments at each level of government exercise control on land development within their jurisdiction and the provision of the law. Section 28 of the law stated that the approval of the relevant authority must be sought before any development can be embarked upon. It declares that mere application for certain development on land did not imply permission to embark on the development on land.

Grounds for Rejecting Some Development Proposals

Worthy of note is the provision of grounds for rejecting some application for land use developments considered as inimical to socio-economic utility. The following laudable grounds were provided for rejecting an application for development permit;

"Where the plan is not in accordance with the approved plan''

"Where the propose use is likely to cause nuisance to inhabitants of the community among others".

Provision for Remedial Actions against Development Contravention

In case of contravention to development approval, "stop work order is served in written form. This is followed by serving an enforcement notice within 21 days of the serve of stop work order. This is done to ensure that the developer restores the land to its original unimpaired state. The law makes provision for a penalty on individuals who disregard the stop work order or fail to comply with the terms of reference of the enforcement notice. A landlord that goes against this law is guilty of an offence and liable on conviction to a fine of not exceeding in case of individual ₦15,000.00K and ₦50,000.00K in case of corporate organisation. Alternatively, the development control department may choose to carry out demolition of the structure considered as nuisance to the occupiers or the public. A demolition notice is served containing a date not later 21 days for the demolition exercise with the cost of demolition paid by the offender.

Commentaries on Land Market and its Regulatory Framework

Access to land is encapsulated in two markets; viz formal and informal land market. The formal market is an offshoot of an attempt to nationalise land. Subject to promulgation of the Land Use Act of 1978, all traditional land tenure systems were repealed and all land in each state was vested in the state Governor. Among other objectives, it was believed that the statutory land law would guide and coordinate the land market. The informal land market is otherwise known as the private land market. Land parcels in this market are freely traded by family and individual with or without any formal records.

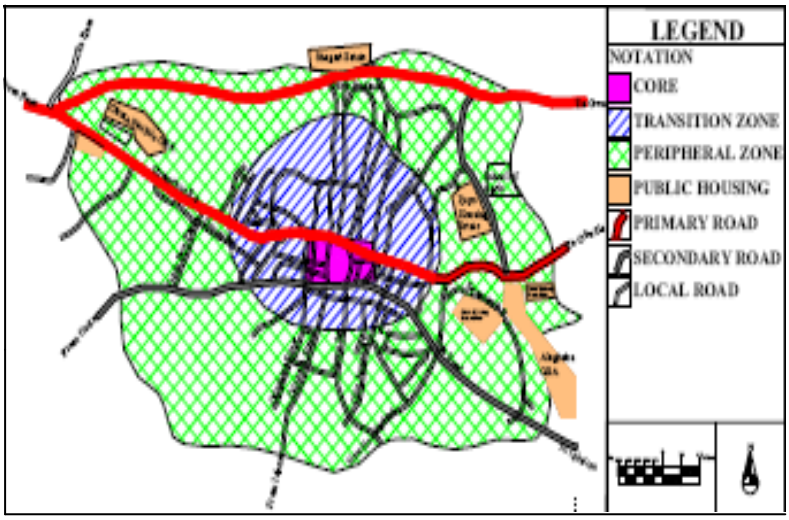
Despite the attempt to formalise the land market through promulgation of the Land Use Act, the informal land market continues to grow and represents the surest means of accessing land. This view is exemplified by different studies carried out by Mabogunje (2010), RICS (2010), Balchin (1995) and Dale (2000). They all observed

a land market operating in isolation and independent of any regulatory framework. They concluded that such an unguided market determines urban spatial structure and compromises the principle of equity, convenience and sustainable urban development. This view is supported by Mattingly (1991) in his study on urban land market in developing countries which revealed that mainstream planning practitioners' saddled with the responsibility of land use control show little awareness of the urban land market in which they intervene. Also, E.C.A (2006) noted that Nigeria and other African nations are facing common land policy issues; which are manifest in different historic, geographic, demographic, social and economic contexts. The study noted the gap between policy making and the documentation of successful implementation of such elsewhere. They opined that land use laws lack empirical knowledge of national and local circumstances and are generally not context specific.

Study Area

Akure is the capital and the largest city in Ondo State in South-western Nigeria. The city has a population of approximately 387,087. The people are of the Yoruba ethnic group. It is located on longitude $7^0$15'00"N and Latitude $5^0$11'42''E of the equator. Less than 10% of the city is made up of public housing while over 90% of the city comprises of private housing districts built on land purchased from informal land market.(See figure 1 for detail)

Figure1. Map of Akure Showing Private and Public Residential Estate.



Source: Ondo State Ministry of land and Housing 2012.

Research Methodology

This paper is basically anchored on observation and personal interview in a pilot study carried out on an on-going research work.

Sampling Technique

This study adopted cluster sampling technique because homogenous groupings are evident in the statistical population. Therefore twenty streets were randomly selected from different groups of residential areas in the city. These were carefully observed for evidences of graves on the residential properties.

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Interview

Oral interview was conducted on telephone to elicit useful information from land officers in the ministry of land in the study area.

Notable Gaps in Urban Planning Law and Causes of its' Inefficiency in Akure

A striking thought is that land use laws are conceived as if they act by themselves which is contradictory to the principles of making and using laws. This view is consistent with Van and Beunen (2009) who asserted that space is only affected by laws after the laws are enacted. A major efficient performance requirement of any law is in its ability to explicitly spell out the dos and don'ts concerning a particular expectation on land use. The ambiguous nature of Nigerian urban regional planning law did not provide a list of land uses considered as nuisance on residential properties. Although this is considered as the nature of most laws whose efficiency is hinged on correct interpretation. Basically, it is inferred that urban planning laws are left to act by themselves. It might be erroneously believed that the occurrences of graves on residential properties were based on express approval of the urban development laws. This may be considered valid, as occurrences of graves would be deemed to have taken cognisance of section 28 of the law which requires approval of any proposed land use decision before its execution. Nuisance is one of the most complicated aspects of law; Prosser (1971) in Swanson and Konteleon (1999), *comments that "there is perhaps no more impenetrable jungle in the entire law than that which surrounds the word nuisance''.*

Basically, Anglo-American concept of urban planning conceives anything that violates zoning principles as nuisance. According to Swanson and Konteleon (1999), the emergent of new law and economics paradigm in the mid 20th century recognised that traditional nuisance law faced several doctrinal and practical shortcomings. Nuisance as one of the basis for rejecting application for some land uses has not been fully explored to deliver the inherent benefits of zoning. Responses from interview conducted in the Ministry of lands revealed a bias in the interpretation of the urban planning laws on private residential estate and Government residential estate. It was discovered that urban development impliedly assumed two parallel meanings to the term "nuisance" on graves. The first meaning perhaps permit graves on private residential land does not consider graves as nuisance. Efficiency of planning is further weakened by allocative inefficiency in the private land market which is at variant to the initial assignment of property rights.

The second meaning impliedly considers graves as a nuisance which should not be allowed on government residential estate. This interpretation of nuisance on residential property is noticeable in the terms and conditions for allocating land on government's residential estates. Prohibition of graves on Government residential land is expressly stated in the terms and conditions which any allotee must agree to before such land is granted.

The efficiency of planning laws to prohibit graves on residential properties' is further weakened by two parallel land markets (formal and informal) in operation. Regrettably, informal land market which is largely unregulated account for 80% of the land holding in Akure and most Nigerian cities. Therefore, it is obvious that the future of the city is in jeopardy if nothing is done to harmonise the working of the property market.

The Effects of Graves' on Property Transaction

The effects discussed here are absolutely based on result from observation and pilot study. Observation shows that vacancy rates are higher in residential properties with graves. This is further corroborated by simple Willingness to Pay survey (WTP) conducted on a group students. Out of 104 youth, only 1 student representing less than 1% was willing to buy a bare residential land/housing with grave. Conversely, the remaining 103 people show their willingness not pay any amount of money for such properties because of the stigma caused by imposition of grave on them. As this paper is a product of an on-going study which is largely concerned with the economic valuation of non marketed disservice; we believe that the effects of graves on economic value of residential properties will emerge from a wider perspective at the advance stage of this work.

CONCLUSION

The underlying argument of this paper is that, urban planning law is inefficient to prohibit location of graves on residential properties in Akure. It noted the provision against nuisance on residential land use; but the context has not been fully explored to clear the latent ambiguity in the polemic concept of nuisance. Therefore, it advocates a review of urban planning and development control laws to spell out prohibition of graves on residential land. This should be strengthened by highly empowered development control workforce for successful enforcement and high level of compliance. This step will help to ensure that property and development control are not left at the mercy of private landlords concept of highest and best use to the detriment of sustainable property transaction and development. It also suggests need to educate current land owners on the limitation of their property right and the need to transfer such right with an unimpaired value. This include recognition of transient nature of their right in a natural gift belonging to the past, present and unborn generation. Government should harmonise the two parallel land markets so that prohibition of graves on residential properties can be sufficiently interpreted within the context of nuisance on both private and government residential estate. Efforts should be channelled towards to acquiring more land from private landlords to increase the expanse of Government Residential land. This is necessary to reduce development of private residential land areas which are largely unregulated. In view of ambiguous nature of the planning and development control law, the author calls for periodic review to keep pace with changes in human behaviour which may constitute nuisance on residential properties. Finally, more attention should be devoted to the interpretation of urban planning laws to guarantee its' efficiency on both private and government residential areas.

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Prospect and Sustainability of Property Development on Highland and Steep Slope Areas in Selangor-Malaysia: Re-Examining of Regulations and Guidelines

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Abstract:
Governing property development has always requires a holistic approach in decision making. The legislations for property development that are in placed still could not ensure the sustainability of development pertinently on highland and steep slope areas. These areas need more detail consideration and approaches specifically in the development process, implementation as well as the monitoring aspect. In lieu of that, the current planning, development guidelines and regulations have been evaluated as to examine the effectiveness of the current development mechanism in ensuring sustainable highland and steep slope development. Evidences from the case study have shown that the weaknesses lie in the decision making process, implementation and enforcement aspect of the property development process which have high influence in the property development growth and values. Besides, the study also revealed that property legislation setting should provide the implementation mechanism. Recommendations to ensure the prospect and sustainability of high land and steep slope development are emphasis on the needs in continuation of legislations and implementation procedures, monitoring actions as well as the necessity for the development players to collaborate and understand the important of sustainable development.

Keywords:
Highland, Legislations, Property Development, Steep Slope Areas, Sustainable.

1 Introduction

Malaysia has a complete, efficient and integrated guidelines and regulations thus; achievement of sustainable development should a non issue. The most crucial initial reference for development is the development plan which provides strategies and approaches in development with legalisation provision. It defined the allowable plot ratio, density, slope stabilisation requirement, mitigation, presevation of natural waterways, vegetation etc. However, those guidelines has weaknesses that need to be overcomed such as on the implementation and the intensity of the provision in those guidelines. The remedial is crucial to ensure the achievement of sustainble development and economic, social and environmental friendly development.

Major concerns in implementing these guidelines and regulations are the actors in development such as government agencies, politician, non-governmental organisation,

developer, businesses and the public. Achievement and success of the development implementation solely lies to the players. It needs a smart consideration on issues that arises during the implementation stage. Thus, knowledge, awareness, responsibility by all actors is crucial in order to achieve a balance development towards establishing sustainable development.

Continuous Geo disaster incidents especially in high land and steep slope areas need to be addressed accordingly. Public has stated the issues and concern on safety, land use planning, law and regulation, management, maintenance, accountability, funding and professionalism pertaining to development sustainability on high land and steep slope area. Basically public has lost their confident regarding to decision making which has been accommodated with planning and development tools, guidelines and regulation. The guidelines are not clear and some do not add value to safety, environmental protection and sustainability. Many issues are unclear and need improvement. The best thing is to get the local authorities to form a taskforce committee comprising professionals from the stakeholders who are familiar with hillside development to look at these issues and formulate clear and comprehensive guidelines and policies. Although there are existence of various regulations and guidelines for highland and steep slope development, issues such as geo-disasters, unsustainable development, public concern, effected development and economic growth remain unsolved. Based on the current development scenario and geo hazards incidents, it is foreseen that the development on high land and hill slope area requires a stringent legal and planning implementation procedure. Thus, it will affect the prospect for future property development in high land hill slopes area. It is crucial to search for the best approach and guidelines for sustainable high land hill slope development that is aligned with property development growth.

Economic Planning Unit (2002), defined high land as areas located at the height level of between above 150 meter from sea level. The definition was futher emphasised which emphasised on permissible development by National Physical Plan for Environmental Sensitive Area (ESA, 2005) as only areas with contour above 150 meter - 300 meter (ESA Rank 3) is permissible with controlled development where the type and intensity of the development shall be strictly controlled depending on the nature of the constraints.

2 Property Development in Highland and Steep Slope Areas

2.1 Legal Framework

In the development process, there are other related laws such as Town and Country Planning Act, 1976, (Act 172) Local Government Act, 1976 (act 171), Environment Quality Act, 1984, Uniform Building By Law, 1984, Street Drainage and Building Act 1974 etc. Beside those laws there are guidelines such as planning guideline, environmental guidelines, buildings guideline etc. Furthermore, development plans are prepared under the Town and Country Planning Act, 1976 (ACT 172) base on National Development Planning Framework comprises of three level such as national, state and local level. These plans provide a integrated top down development plan and strategies focusing on physical, environment, economic and social aspects towards vision 2020 (national development objective) (Bruton, 2007)

The governmental machinery which lies on Federal Constitution provides further avenues of federal influence over the state governments. Such influence is exercisable over matters that

are even listed under the state list of the Constitution (Hamzah, 2009). The four other national councils, the National Council for Local Government (NCLG) under article 95A, the National Land Council (NFC) under Article 91, and the National Finance Council (NFC) under Article 108 and National Physical Plan Council (NPPC) under chapter 2, ACT 172 are chaired by the Prime Minister or his appointee. Representatives both from the federal and state governments sit in these committees (Bruton, 2007).

The governmental machineries has been further strengthen by various agencies such as Ministry of Housing and Local Government (MHLG), Ministry of Natural Environment (NRE), Town and Country Planning Department (TCPD), Department of Geology and Mineral (DMG), Department of Environment (DOE), Department of Road and Work (DRW). These agencies and regulation are the tools to deal with development pertaining to High Land and hill slopes development. National land Code, 1965 set the provision pertaining for land matters, whereby land matters is state matter and decision on the land development were made by the State Executive Committee (EXCO) (Bruton, 2007).

2.2 Highland and Steep Slope Development Scenario in Selangor, Malaysia

The changes on the Malaysian geographical setting generally has effects on high land and hill slope development. It is showed that the geo disaster in Malaysia have started since 1919 and causes lost of life, properties and effected the economy. Major concern for high land and hiil slopes development increased during the Highland Tower, Bukit Antarabangsa collapsed on 11 December 1993 and the geo disaster continues with higher fequency and nos. since 2004 to 2009. The New Straits Times reported on 12 June 2006, that eighty per cent (80%) of Hulu Klang is at risk of landslides and that a soil expert said a study done two years ago showed that some areas in Hulu Klang sat on "schist rock", the weakest rock on which to carry out any sort of development.

Previously the geological aspect seems to be neglected in planning development. The geological setting is among the most important aspect that need to take into account in examine any development. The awareness of geological and geographical setting that change upon climate changes and natural disaster is still lacking in the decision making. However, the State of Selangor has responded to the geo disasters incidents and issues, the state of Selangor government has taken action to ban the development on High Land and hill slopes that have class III and IV catogery in 2nd April 2008. The action was taken by the government to prevent and control more disaster from hapenning. However, it has effected the property development and economic growth as a whole. According to Hutchison, banning development on hillsides is a good measure because it will minimise the clearing of natural vegetation (Hutchison, 2009). On the other hand (LPHS, 2008) 136 development projects classified under class III and IV are on hold classified which had direct effect on property development growth. In lieu of the drastic decision,. Various parties such as REHDA, developers, investors have appeled to the state government to reconsider the decision to cater the development constraints problem in Selangor and the effects on the economic and development growth and property values. (State of Selangor, 2009). However, Kong (2009) argued that it is is unfair to developers because many have purchased land and have outstanding bank loans to service. With the ban, there are less available land to build on. and faced financial losses. There have been many misconceptions regarding such developments. Class 4 slopes (more than 35°) had been successfully developed in countries like Hong Kong and Taiwan (Gue, 2009).

The following are incidents of landslide which have been occurring regularly on and along the hills situated in Hulu Kelang :-

i. 1985 - Taman Melawati, Jln G1
ii. 1993 - Highland Towers
iii. 1999 - Athenaeum Tower
iv. 2000 - Bukit Antarabangsa
v. 2001 - Taman Hijau
vi. 2002 - Taman Melawati, Jln G1
vii. 2002 - Taman Hillview
viii. 2006 - Kpg. Pasir, Taman Zoo View
ix. 2007 - Taman Melawati, Jln H1 and H5
x. 2008 – Bukit Antarabangsa

(source : Mineral and Geosciences Department, State of Selangor, 2010)

2.3 Reviewing Guidelines for Hill Slope Development

According to a census carried out by Real Estate and Housing Developers Association (REDHA) in 2010, there is an estimated 1,800ha of hillside land in Selangor valued at about RM1.4bil. According to the Cheif Minister State of Selangor, many developers have urged to reconsider and made a number of appeals to review the guidelines set earlier, where all Class 3 and Class 4 development was banned. (The Star, 2009)

There are fifth teen hillside housing estate in Ampang and Pandan areas which is next to Bukit Antarabangsa have been identified by the Selangor Government as being at risk of landslides. These areas will now come under continuous monitoring by local authorities. The areas identified are Bukit Antarabangsa, Ukay Heights, Taman Hijau, Taman Hillview, Dataran Ukay, Taman Melawati, Ukay Perdana, and Taman Kemensah. In the Pandan constituency, the risky areas are Taman TAR, Bukit Sungai Seputih, Bukit Teratai, Bukit Permai, Taman Saga, Taman Mega, and Bukit Segar.

State of Selangor topography consist of 47% of high land. Development on high land and hill slope area started in the middle of 1980's and grow rapidly in early 1990's and continues to present. The State of Selangor Planning and Development Direction has indicated land use distribution of the Selangor comprises of 39.7% for built up develop area, 30 % for forest 30% for agriculture and 21% for water body (2.1%). Thus, it limits the development area and has put pressure and demand for land which resulting violation on high land and hill slope as the best option to cater the demand. In light of the many hillside tragedy, Selangor state has drafted new development guidelines for Class 3 (more than 25-to-35 degrees) and Class 4 (35 degrees and above) slopes. Class 4 slopes, the most critical area with a combination of slope angles and located 150m above sea level or higher, are protected under the Land Conservation Act.

2.4 Development Issues on Highland and Steep Slope Areas

Chan (1998) mentioned that landslide and hill slope development are not new in Malaysia. The desire for rapid economic development in order to catch up with the developed world is often over-emphasized and this can lead to an unbalanced development strategy which often sacrifices environmental principles purely for the sake of economic gains. Chan (1998) indicated that forest clearance, whether due to logging, farming, housing or other environmentally damaging human land uses have significantly altered hydrological parameters. Chan (1998) also discovered in Malaysia, the natural elements, particularly the

weather elements, are highly erosive. Geomorphological processes such as rain splash erosion and surface run-off erosion have been shown to be extremely high in wet equatorial areas. Given the high intensity of our rainfall within short durations, the erosivity of rain and run-off are main causes for loosening the soil, weakening slopes and ultimately leading to mass movements of solid and semi-solid materials such as soil creep, landslips and landslides. Ooi, 2009 mentioned that the recent Bukit Antarabangsa high profile landslide also happened during a period of incessant rainfall with the failure of a 20-year-old tip-fill uncompacted slope. Poor drainage maintenance and tip-fill slopes were again the common factors that caused landslides.

Chan (1998) also discovered that cleared areas are not immediately replaced by concrete or other surfaces but left for considerably long periods before projects are finished. For example, the average duration of a housing project may take between a year to a few years. Thus, this leaves the cleared surface exposed to the elements of nature. Tan (2008) has further supported chan statement in light of the latest landslide tragedy at Bukit Antarabangsa in Ampang. Gue (2009) further added that the Highland Towers collapsed because the wall and slopes were not properly engineered and the drainage not properly done. The abandoning a hillside project would not necessarily make the place safe. Hutchison (2009) quoted that engineered slopes are never 100% safe as it lies on layers of sandstone and mudstone sitting on overlying limestone and rainfall volume. Faisal (2009) further added that features of unsaturated residual soils indeed very important. It is difficult to assess slope stability using analytical methods, as well as the use of vegetation for the prevention of slope failures. However, Ng, 2009 believes that zero maintenance is not the solution, as it may be very costly. All hills may end up as concrete hills as a result. Zakaria, 2009 agreed that deep cuttings would require high maintenance cost by the local authorities. Chen (2009), has pointed out that with the existence of so many agencies; everybody wants to be part of the solution. However, it seems to be running in all directions, thus he suggested that perhaps it should be centralised to one agency and monitored established panel of slope. Even if the houses have been given the Certificate of Fitness (CF) by the authorities, hillslopes are so vulnerable to the harsh realities of the Malaysian weather and all to frequent rainfall that would render the CF to be not worth the paper it's printed on (Bernama, 2009).

Kwan (2009), urged that there must be a proper policy, legislation and regulation governing hill-site development to make it sustainable which a stronger political will, a holistic approach and the involvement of professional and industrial players. Five points to urge the authorities to consider implementing comprehensive measures for high land and hill slope development as follows (Ng, 2009):.

i. The relevant authorities need to carry out a survey and classification on existing hill slopes nationwide on the development worthiness and identify those critical areas prone to erosion and landslide, and inform the public of the findings.
ii. Concrete policy and regulation on how hill slope development should be regulated and implemented.
iii. The authorities need to setup a specialised agency to oversee the formulation of policy rules and regulations on safe development and maintenance on hill slope development as well as the implementation and enforcement of these rules and regulations.
iv. The developers have to ensure that any future hill slope development is safe for the habitation of house buyers.
v. Responsibility and liability are currently insufficient. We want to make those culpable accountable, impose on them a stiffer penalty and imprisonment because we are

dealing with human lives.

Chan (1998), highlighted Malaysia's commitment towards environmental protection is clear, as there are policies, laws, regulations and EIA requirements in developments which can have an effect on the environment. Unfortunately, however, despite this commitment (and its international stance against environmental degradation),. Furthermore, Hutchison, 2009 finds that EIA reports that are very thick but are filled with all sorts of technical jargon and equations that do not being well understood, thus it seems uninformative. Many aspects of Malaysia's environment on the local front is still being exploited and degraded by irresponsible parties Chan (1998).

Ng (2009), pointed out that hill slope development today was not any safer than it was 16 years ago. As the guidelines consisting of the four classifications of slopes, Class 1-4 , was the only thing that we could access to. Furthermore, there were no other proper hill slope development guidelines that are accessible to the public. However, Dahlia (2009) pointed out that the Federal Department of Town & Country Planning places the development of programmes and community related to the conservation of natural resources, environmental protection and social stability as a priority. These priorities are translated into the National Physical Plan and also the National Organisation Plan, as well as the state level plans and district plans. These plans were based on policies and guidance for developmental procedures or planning commission procedures by the local planning authority. Zakaria (2009) expressed concerned about the development proposals of very steep and very high cut slopes that do not include comprehensive study on site assessment. It also need further emphasised on the important to look at upstream and downstream development as well, and come up with something comprehensive Chen (2009).

3 Objectives of the Research

The research objectives are as follows:

i. To examine the issues and problems of property development on high land and steep slope areas.

ii. To evaluate the effects of current planning and development guidelines and legalisation on property development and property value for high land and steep slope development.

iii. To examine the property development prospect and sustainability on high land and steep slope areas.

4 Methodology

The research focused on the development issues, implementation problems and property development prospect pertaining to property development in highland and steep slope area. The analysis has been carried out on the provision of planning and development guidelines and development plan, physical development trend and property values. Data was collected from various technical department and government agencies such as Town and Country Planning Department, State of Selangor, Mineral and Geosciences Department, State of Selangor, Ministry of Federal Territory, Ministry Of Natural Resources and Environment,

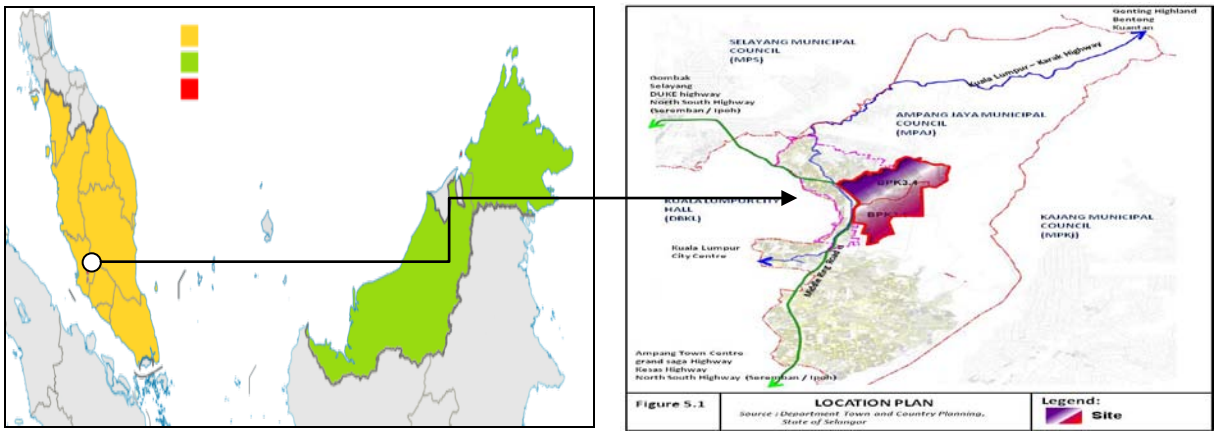
Malaysian Meteorology Department and Valuation Department, State of Selangor and Ampang Jaya Municipal Council of which will base on secondary data. The fundamental basis of data collection is referred to the case study in Bukit Antarabangsa, State of Selangor. The analysis was based on the study areas and other secondary data including government policy, development plan, property reports, planning regulation and guideline for high land and steep slope areas development.

5 Analysis of Findings and Discussion

The data is analyse and evaluated to measure the effects of the current guidelines and regulation on property development, property value and on high land and steep slopes areas.

5.1 The Case Study Site

The case study site is located at the western part of Gombak District (Mukim Hulu Kelang) in the State of Selangor and is bounded by the Federal Territory (Kuala Lumpur City Hall) jurisdiction area). The study site is under the jurisdiction of Ampang Jaya Municipal Council. Ampang, State of Selangor and is an established development area consists of existing, committed development and preserve areas. Generally, the study site is a built up area, which dominantly developed with housing. The Major Land use for the study site is housing of various types commercial, agriculture and forest area in an area of 914 hectares (2,267 acre). 82% of the study site is developed. The rest of the site comprised of undeveloped land, patches forest (part of Ulu Gombak Forest Reserve) and agriculture area which is 18% of the total study site. The study site has been permitted for development mainly for housing and commercial. *(Figure 5.1)*



The study site is built up area and land for development is limited. The study site is located at a strategic location surrounded by developed area, major towns and highly accessible for major road and highways that connects locally and regionally. However, the study site generally in unstable position in physical development context due to numbers of geo-disasters occurs within and adjacent to the study site. Development for this area need to be monitored and considered based on stringent planning control. It requires continuous monitoring, maintaining and managing mechanism in the implementation processes. The crucial aspects that need to be focused are on safety, environmental preservation and development sustainability. Thus, planning and development guidelines need to be precised, stringent and implementable.

5.2 Planning and Development Guidelines and Regulations for Highland and Steep Slope Areas Development

Planning and Development Guidelines and acts pertaining to hill land and steep slope development has been developed since 1970's. Those guidelines and acts was formed in policy, regulation, legislation, guidelines and implementation procedures to ensure a sustainable high land and steep slope areas development. The current Planning and development Guidelines and legislations for High land and Steep Slope development has been developed since 1997 to 2010 are as follows:

i. Ampang Jaya Draft Structural Plan 1995-2020, 1997
ii. National Physical Plan,2005
iii. High Land Development Guidelines, Ministry of Environmental and Resources, 2005
iv. Draft Guidelines for the Conservation and Development of Environmental Sensitive Area and its Surrounding Area, 2005
v. State of Selangor Structure Plan 2020, 2007
vi. Planning Standards Guidelines Selangor of Selangor, 2007
vii. Ampang Jaya Draft Local Plan 2020, 2009
viii. Development and Planning Guidelines for Hilly and High land Area, Ministry of Housing and Local Government, 2009
ix. Development and Planning Guidelines for Hilly and High land Area, State of Selangor 2010

Planning and development guidelines and regulation regarding to high land and steep slope area has been developed since 1997 until 2010 either in policy form or implementation guideline form. There are 9 related planning and development guidelines for high land and steep slope area have been referred for permitting development. There are various emphasises and considerations on approaching the control mechanism for high land and steep slope area development. Thus, the current planning and development guidelines will give impact towards the property development and property value on high land and steep slope areas. It has been indicated that the guidelines has under gone an evolution in dealing with the development trend and approaches which led to the changes of the guidelines variables as well as it emphasising towards stringent and stricken development requirements. The changes are as shown in **Table 5.1- Appendix A.**

The consideration in permitting development and its density as indicated in the current guidelines was based on the followings variables:

i. Development Suitability classes
ii. Height / contour level
iii. Slope gradient
iv. Environmental Sensitive area (ESA) classes
v. Risk Classification.
vi. Technical report such as such as Development Proposal report, Geo-Technical Report, Erosion and Sediment Control Report, Environmental Impact Assessment Report and Earthworks Plan.

Prior to 2005, the variables used was slope gradient and risk classification that allow high, medium and high density development in low laying areas and low and medium risk area. Restriction for development on high land and steep slope areas covers for steeper and higher risk area as well as emphasising on topographical preservation. In 2005, the policies and

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guidelines for high land steep slope area has use more variables that emphasise on Development Suitability classes, height / contour level, slope gradient and ESA. However, the risk classification variables have not been taken into consideration. In term of policy making, NPP emphasise on ESA and height / contour level. It is foreseen that the concern is more towards environmental preservation and slope stability, and the direction was express in the policy. The policy indicated allowance for medium and high density development in low laying areas and low and medium ESA area. Restriction for development on high land and steep slope areas covers for higher and riskier area and emphasis on topographical preservation. For implementation wise, the guidelines changes the emphasis by using Development Suitability classes, Slope gradient, ESA require technical report. These guidelines allow for low and medium density development in low laying areas and low and medium ESA area. Restriction for development on high land and steep slope areas covers for steeper and higher ESA area and emphasis on topographical preservation. In 2007, the planning and development policy and guidelines has neglected the consideration of Development Suitability Classes and Risk Classification. For the policy making purpose, only slope gradient is used as the variable. The policy emphasised on slope stabilisation in the sustainable environmental context. This is use as a basis for further implementation of the guidelines. The implementation of the guidelines has incorporated height/contour level, slope gradient and ESA classes as the variable and also requires technical report submission. The guidelines permitted development for low, medium and high density development in low laying areas. Restriction for development on high land and steep slope areas covers for higher area and ESA area and emphasis on topographical preservation.

In the first half of 2010, the planning and development guidelines concentrated on Development Suitability classes, height / contour level and slope gradient as the variables. However, on the second half of 2009 and first half of 2010 the guideline strongly emphasis on the development Suitability classes, height / contour level as the variable and requirement for technical report submission. The guidelines permitted development for low, medium and high density development in low laying areas. Restriction for development on high land and steep slope areas covers for higher area and Class IV area and emphasis on topographical preservation. It was revealed that the major concern in high land and steep slope development is the topographical preservation towards safety, environmental and physical sustainability. Changes in variables indicated the importance of the development suitability classes and height / contour control. The verification development suitability classes are taken into consideration the geological setting, slope stabilisation, risk and environmental consequences, thus it is a comprehensive variables. It is seems that the changes shows some inconsistency in approaches of controlling for high land and steep slope area development. Generally low, medium and high density development is permissible on low lying area. For high land and steep slope areas, low and medium density is permissible. However, for higher land especially categorize as class III, low density is permissible with stringent requirement for technical report such as Development Proposal report, Geo-Technical Report, Erosion and sediment Control Report, Environmental Impact Assessment Report and Earthworks Plan to be submitted for development evaluation. For Class IV and higher land level, any kind of development is not permissible except for infrastructure such as road, tunnel, bridge, telecommunication & electric tower. Even then, the development guidelines should be amended whereby it needs to take a holistic consideration of all variables used during the changes to avoid mislead and to confirm for best development control on high land and steep slope area.

5.3 Physical Development Trend and Encroachment

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Early development in the study site began in highlands and steep slope area. The early development approaches were low and medium density development with no reference on development and planning guidelines. It shows that development issues has not emerged and does not effecting the environment, physical, economic and social sustainability. The need for planning and development guidelines is seemingly less important by looking at the development growth in 1990 to 1993 that encroaches to highland and steep slopes areas. The highland tower incident in 1993 shows some indicator for the need of planning and development guidelines especially concerning on safety, mitigation, slopes maintenance, geological inputs etc. As highlighted, there were no development activities in 1994 to 2004. Thus, Ampang Jaya Structure Plan 1997 was in place which imposing policies and guidelines pertaining to highland and steep slope development with consideration of those factors.

Various development plans, planning and development guidelines were in place in 2005-2010. However, those guidelines are varies on the emphasis aspects and variables. The common concentrations of those guidelines were on the environmental sustainability and topography preservation. Those guidelines are incrementally to be more stringent in permitting development and impose various technical reports to ensure development's sustainability. Having those guidelines, the development has growth rapidly in 2002-2010. However, there were doubts regarding to the guidelines efficiency and effectiveness as refer to the 4 geo disaster events happen in the study site in 2004 to 2010. The pertinent issues that need to be address is the allowable development density and mitigation measures for high land steep slopes development. It is foreseen other aspects should be the main concern such as monitoring, maintenance, enforcement, responsibility, liabilities etc that need to be imposed to stakeholders on highland and steep slope development. It is shown in **Figure 5.2 – Appendix B.**

5.4 Impact on Property Development and property value in high land and steep slope areas

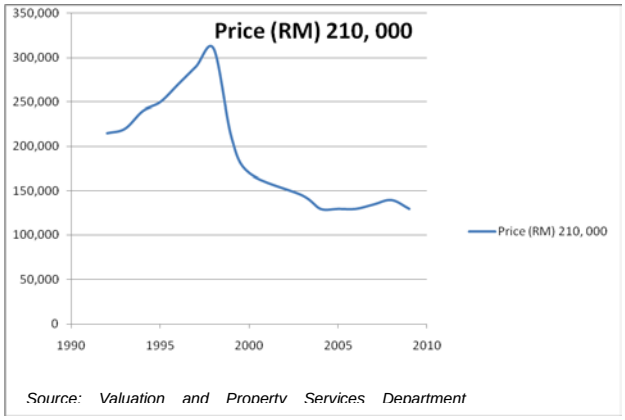
5.4.1 Fluctuation in the property prices in lieu of the geo-disaster (landed and strata)

The geo-disaster events have given a huge impact on the property prices in Bukit Antarabangsa particularly to the affected areas such as Bukit Antarabangsa, Taman Hillview and Taman Bukit Mewah. The analysis below demonstrated the fluctuation of property prices in those areas for strata as well as landed property.

5.4.2 Strata property – Puncak Athenaeum Condominium (Bukit Antarabangsa)

Puncak Athenaeum is a 340 unit of condominium housed in two towers of 21-storey. Located in Jalan Wangsa, Bukit Antarabangsa, the condominium was collapse in 1999 which caused 4 deaths.

It was shown that the prices of Puncak Athenaeum starting from year 1991 were appreciated until the year of 1998. Unfortunately, the values of the condominium unit were fall off on the following year due to the geo-disaster tragedy. The percentage of fall is approximately 30% from the preceding years (1998) due to the fear factor as well as the tragedy that scared potential



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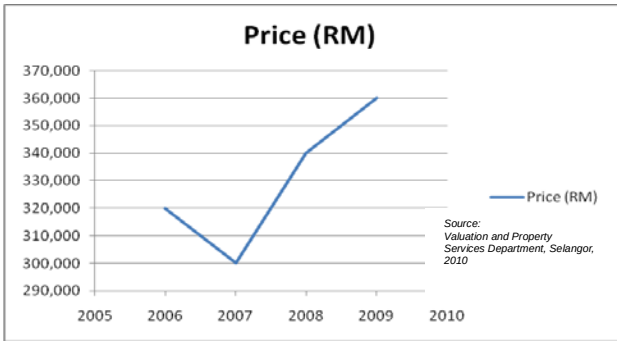
purchasers and investors away for security reason. The condo prices were continued to fall until year 2000. As shown, there were no transaction recorded between year 2001 and 2002 as purchasers has no confident to buy the condo in lieu of the tragedy and the possibility of the geo-disaster to repeat within the short period of time. The property value for the said condominium was badly hurt. Nevertheless, purchasers' confidents were started to grow as there were transaction recorded in the year of 2003 but with depreciate price. The prices of the condo unit were stagnant up to year 2006. Year 2007 and 2008 recorded an appreciation of price for approximately 4%-8% of the preceding year. The recent data transaction (2009) recorded the depreciation of the condo price. This is assumedly due to the 2008 Taman Bukit Mewah tragedy as purchaser and potential were scared that the same tragedy will again happen to Puncak Athenaeum Condominium.

5.4.3 Landed Property – Terrace Houses (Taman Ukay Bistari)

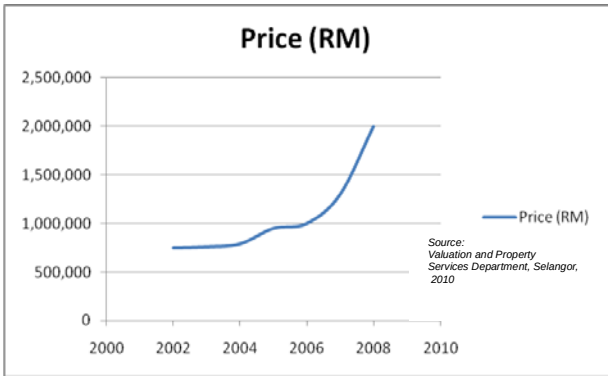
The Kg. Pasir tragedy that occurred end of 2006 has slightly impacted its surrounding property such as Taman Ukay Bistari that located at the southeast boundary of Kg. Pasir. The fluctuation of property prices particularly landed property i.e. terrace houses are as shown below.



The price of the terrace houses in Taman Ukay Bistari for the year 2006 was recorded before the tragedy which was around RM320, 000. The following year after the tragedy recorded a slight fall approximately 6% of the price for the preceding year. An approximately 13% growth in price were recorded in 2008. It shows that the Kg. Pasir tragedy does not give a significant impact towards property prices in its adjacent neighbourhood. The latest transaction (2009) recorded a further increase for the terrace houses in Taman Ukay Bistari as the confident level of the potential purchaser and investors toward that area has restored.

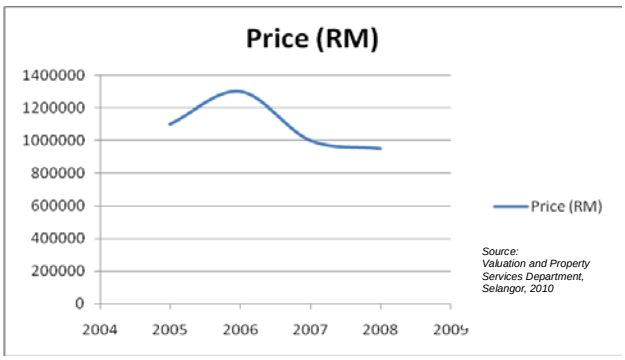
5.4.4 Landed Property – Semi-D (Taman Beverly Heights)

Another most famous landed property in Bukit Antarabangsa area apart from terrace and
bungalow is semi detached house. Taman Beverly Height is chosen a this area is located further away from any geo-disaster area that have occurred in Bukit Antarabangsa such as Taman Bukit Mewah, Kg. Pasir, as well as Taman Hillview (not included in the study area). Taman Beverly Height which was approved in 2002 sold its semi-d at RM750,000. The transaction data in the following year recorded an increase to RM760,000. As shown in the above table, the price of semi-d houses in Taman Beverly Height was continuously increased up to the latest transaction recorded in 2008 for RM2.0 m. It is obviously shown that the price of semi-d in the said area was not affected by any geo-disaster tragedy in Bukit Antarabangsa i.e. Kg. Pasir and Taman Hillview (not included in the study area) which occurred in 2006. Thus, it can be concluded that not all geo-disaster that



occur in Bukit Antarabangsa area would affect all property prices within the vicinity, some may still appreciate depending on the safety and confident level of the potential purchaser and investors.

5.4.5 Landed Property – Bungalow (Taman Bukit Mewah)



Taman Bukit Mewah tragedy in late 2008 has raised many speculations and issues in lieu of the safety for development in hill side and hill slope area. Tragedy that killed 5 people has resulted to the review as well as enforcement of additional guidelines pertaining to hillside and hill slope development. The price of bungalow prices in Taman Bukit Mewah was recorded at 1.1 m in the year 2005. There were increments approximately 18% in the following year (2006). The sale prices were declining in the year 2007 was due to the Kg. Pasir and Taman Hillview (not included in the study area) tragedy which gave fear to the residents especially to bungalow residents. The prices were continued to decrease to 950,000 in 2008 as the confident level were still low. The Taman Bukit Mewah tragedy which occurred during end 2008 has worsened the scenario. There were no transactions recorded in 2009 as the tragedy that has snapped up 5 lives is still fresh in everyone's memory.

6 Conclusions and Recommendations

Generally, the present legislation, development and planning guidelines are relevant and friendly to the property development specifically for the high land and steep slope development. However, the main concern is on the inconsistency of variables used in the guidelines that neglecting important aspect such as environmental sensitivity and category of allowable development. As at 2009, the development and planning guidelines has consistently aligned and uniformed all variables and provisions required in permitting development which strictly emphasised on environmental sustainability, topographical preservation, safety and mitigation aspect. However, the improvement and remedial actions need to be concentrated in implementing development continuously. Therefore, sustainable high land and steep slope development could be achieved as well as to safe guard the property value.

The present development guidelines for highland and steep slope area do not give a huge impact on the development growth as evidenced by the development trend in the study area. The analysis also revealed that the property value in the study area are still maintained and sustained throughout the year even though the current development guidelines has outlined certain restriction as well as imposing stringent development control for certain area on highland and steep slopes development. The only concern that threaten the property value on the above said area is the unforeseen geo-disaster events that beyond human control. In lieu of the unpredictable of climate changes, there are many unimaginable disasters that may happen especially to disaster-prone area such as Bukit Antarabangsa.
Nevertheless, those depreciated property value will not last longer. This is a result of the revision of the existing planning and development guidelines pertaining to highland and steep slope area especially after each tragedy, and we can see that the mushrooming of new development on the surrounding areas (i.e. tragedy area) right after the enforcement of those

new guidelines.. Therefore, it can be concluded that, the present planning guidelines pertaining to high land and steep areas development specifically to the study area are suitable and generally sufficient to sustain and to boost up the existing development prospect.

As mentioned above, the current planning and development guidelines are generally friendly to the current development and so far, it has taken into consideration all important technical aspects pertaining to highland and steep slopes development by requiring all technical reports that assure that the proposed development are align with the carrying capacity for that particular area before development can be approved. Nevertheless, the main concern now are on the implementation, enforcement, as well as continuous monitoring of those guidelines as well as on the flexibility of those guidelines to new development concept such as SOHO, Superlink house, etc.

The crucial facts revealed from the analysis of the study site was the needs for sustainable development which emphasis that the development for highland land and steep slope area need to be considered and monitored based on stringent planning control. The geo-disaster tragedies generally give an impact to the depreciation and appreciation of property values. Thus, the development for this area requires continuous monitoring, maintaining and managing mechanism in the implementation processes. The crucial aspects that need to be focused are on the safety, environmental preservation and development sustainability. Therefore, planning and development guidelines need to be précised, stringent and implementable as recommends in Table 6.1:

Table 6.1: Suggestions for Better Monitoring of Highland and Steep Slope Areas:

No	Suggestion	Explanation
1.	Development Monitoring System	The authorities need to form a monitoring system for high land and steep slope development which will monitor, evaluate and enforce any misconduct of development implementation. The monitoring system should be supported by information technology (IT) such as inventories high risk development, geo-disaster prone area, slopes area, property ownership and etc.
2.	Flexible Planning and Development Guidelines	The planning and development guidelines should be amended and incorporates flexibility aspects. The flexibility should be given for new development concept and approaches such as the usage of high technology material and system that will ensure the development's safety and sustainability. Therefore, the permissible density for instance can be upgraded
3.	Trade off in Complying to Development Provision	Development provision should be considered in giving allowance for trade off. For instance, since class III is only permitted for low density and needed for high financial and class IV is restricted for any kind of development, the provision to accommodate low cost houses should be forfeited and leverage on expatriates ownership.
4.	Legislation Review	As the environmental sustainability and topographical preservation is a crucial aspect to be considered in permitting development, review on the enforcement of the current legislation need to take place. For instance, the provision for trees and topographical preservation as indicated in section V, Town and Country Planning Act, 1976. However, in previous development, the implementation of the provision has not been implemented. Therefore, the said provision should be embedded in the earthwork approval and the trees and topography need to be inventories. Another aspect that need to be embedded in the legislation is the property's owner responsibility towards slope maintenance as well as to effected neighbouring lot from the property development activities. This responsibility should be stated in the land or property title and in should be for perpetuity.
5.	Propose Best Planning Practices for Sustainable High Land and Steep Slope Development	Demand for sustainable development is increasing nowadays. Challenges in dealing with sustainable development implementation are mainly on safety assurance, environmental preservation and physical environmental stability. Thus, the emphasis in planning and development is on the environmental control, natural topography, greeneries, natural waterways and best living environment. Best planning practices

		should be implemented to ensure development implementation sustainability.
6.	Special Area Plan	High land and steep slope area need to be developed systematically and continuously monitored. It is suggested that the Special Area Plan which is a comprehensive plan is mandatory to be prepared for high land steep slope development. It indicated a suitable development area and development implementation approaches. However, the special area plan needs to be enhanced by incorporates financial projection, construction methods, enforcement provision and geological requirements.
7.	Green Development Concept	Highland and steep slope development should impose green development concept which emphasis on natural physical environment and bio-diversity. The important development component is the soft landscape consist of matured trees (existing trees in the development land should be preserve as referred to section v, Town and Country Planning Act, 1976), preservation on natural water ways, scrubs and etc. It should also incorporate the new development technologies such as the green building, energy saving design and appropriate building materials that blends with the natural environment.
8.	Low Density Development	Development on highland and steep slope area should strictly allow for low density only. The development layout must accordance to the topographical terrain and design for minimum earthwork. The new development concept that maximise development plot which is the of balance plinth area, single loading entrance, contemporary and traditional design should be encouraged and to be blended with greeneries components.

In a nutshell, there are always a huge prospect for property development growth and sustainable and increment in property value on highland and steep slopes area in relation to the reviewed planning and development guidelines.

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APPENDIX A

Table 5.1: Guidelines and Regulations Variables Changes

Year	1997				2005				2005				2005				2007				2007				2009				2009				2010			
Guideline	AJSP				NPP				HLDG, NRE				GBDESA				SSP				PSGS				AJDLP				DPGHL, MHLG				DPGHL, SGR			
Development Density	L	M	H	R	L	M	H	R	L	M	H	R	L	M	H	R	L	M	H	R	L	M	H	R	L	M	H	R	L	M	H	R	L	M	H	R
Development Suitability Classes	N/A				N/A												N/A				N/A															
Class I																																				
Class II																																				
Class III																																				
Class IV																																				
Height/Contour	N/A								N/A				N/A				N/A								N/A											
< 150 m																																				
>150 m – 300m																																				
>300m-1000m																																				
>1000m																																				
Slope Gradient					N/A								N/A																N/A				N/A			
<12°																																				
>12°- 20°																																				
>20°- 30°																																				
>30°																																				
ESA	N/A								N/A								N/A								N/A				N/A				N/A			
Class 1																																				
Class 2																																				
Class 3																																				
Classified Risk					N/A				N/A				N/A				N/A				N/A				N/A				N/A				N/A			
Low Risk Zone																																				
Medium Risk Zone																																				
High Risk Zone																																				
Condition																																				
Technical report																																				
Topographical preservation																																				

Low	L
Medium	M
High	H
Restricted	R
	Variable

No.	Guideline	Short Form
1	Ampang Jaya Draft Structural Plan 1995-2020	**AJSP**
2	National Physical Plan	**NPP**
3	High Land Development Guidelines, Ministry of Environmental and Resources	**HLDG, NRE**
4	Draft Guidelines for the Conservation and Development of Environmental Sensitive Area and its Surrounding Area	**GBDESA**
5	State of Selangor Structure Plan 2020	**SSP**
6	Planning Standards Guidelines Selangor of Selangor (2007)	**PSGS**
7	Ampang Jaya Draft Local Plan 2020	**AJDLP**
8	Development and Planning Guidelines for Hilly and High land Area, Ministry of Housing and Local Government,	**DPGHL, MHLG**
9	Development and Planning Guidelines for Hilly and High land Area, State of Selangor	**DPGHL, SGR**

Source : Department of Town and Country Planning, Selangor (2010), MPAJ (2010)

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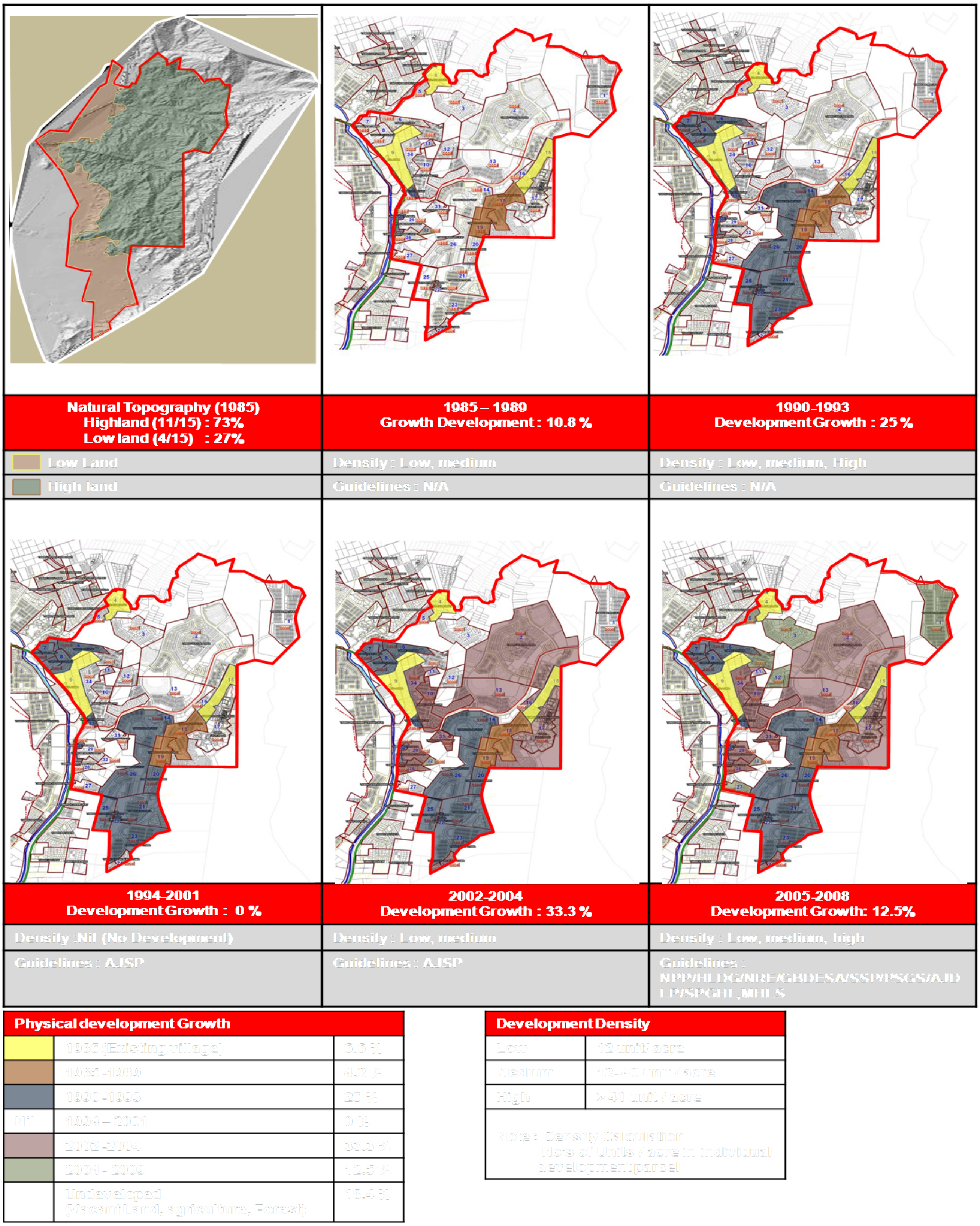
APPENDIX B

Figure 5.2: Development Growth Based on Permissible Densities



Source : Department of Town and Country Planning, Selangor (2010), MPAJ (2010)

A PRELIMINARY STUDY OF SUPPLY VENDOR SELECTION MODEL FOR LNG PLANT PROJECTS

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ABSTRACT

Recently, the demand for Liquefied Natural Gas (LNG) has continuously increased. Also the number of new contracts for LNG plant construction is predicted to continue to increase. In particular, the procurement phase is crucial because it is the largest portion of the Engineering-Procurement-Construction (EPC) project from a total project cost perspective. So, when the problems are incurred by supply vendors such as schedule delay or under performance product, then huge amounts of liquidated damages and additional procurement cost are emerge. So, optimal supply vendor selection to achieve the expected schedule and performance is critical. Nevertheless, variety and complexity of criteria for selecting vendors, despite the research, is insufficient to generalize it. It has resulted in several limitations of current supply vendor selection models. To this end, we develop a Fuzzy-TOPSIS -based model to enhance the reliability of the supply vendor selection process through investigation of the limitations from current models and the characteristics from LNG plant. Then the model is confirmed by applying it to a procurement case in LNG plant projects. Consequently, the suggested model can enhance reliability in the decision making process for supply vendor selection through well-structured, multi-criteria decision making processes and fuzzy logical quantifications.

Keywords: Decision-Making Process, Fuzzy-TOPSIS Method, LNG Plant, Procurement, Supply Vendor Selection Model

INTRODUCTION

In recent decades, the demand for Liquefied Natural Gas (LNG) has continuously increased based on energy security issues and interest in sustainable and green technology. According to the Intergovernmental Panel on Climate Change (IPCC, 2007) report, LNG is a cleaner form of energy than other fossil fuels, such as coal and oil, in terms of greenhouse emissions. The report reveals that the emission coefficient of LNG is smaller than those of other fuels. Moreover, the reserve-to-production ratio is larger than those of other fuels, meaning that we can use LNG as an energy resource for a long time and with fewer negative impacts on Earth. Demand for LNG will experience more growth than will other energy resources (International Energy Agency, 2011). Similarly, demand for LNG plant construction is rapidly increasing.

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Nevertheless, LNG plant construction projects face large barriers because of their own diverse characteristics, such as their large scale, complex mechanisms and low-temperature and high-pressure processes. Therefore, LNG plant design requires a more experienced and skillful approach than do other types of plant design. Specifically, the procurement phase is the most important phase because it accounts for up to 60% of the total project cost and requires unique and strict standards. Therefore, effective and efficient management is directly connected to project success. Generally, procurement describes delivering a suitable product in the planned amount of time to an exact location with the required level of performance and safety. In addition, procurement is performed by contractors and vendors through time, cost and quality management. If the schedule delay or under performance occurred, then the owner faced huge amounts of economic damages. Damages must be transferred to contractors and vendors as liquidated damage. Moreover, re-construction or re-procurement is performed to achieve the expected performances with additional cost and time. To achieve successful procurement, both the contractors' abilities and vendors' abilities are crucial. Several abilities of supply vendors such as technical standards, expected performance, quality/safety/cost control, lead time, strategic relationship and etc. affect the procurement process and its performance, so they needed complex and well-structured Multi-Criteria Decision Making (MCDM) processes that decision making method using various decision criteria for the optimal supply vendor selection. Consequently, procurement should be performed carefully and the decision support model is crucial for the successive supply vendor selection.

PROCUREMENT AND SUPPLY VENDOR SELECTION

Procurement in LNG plant projects

Procurement is intensively related to other processes, such as contracting, design and construction. In addition, it also follows the construction plan. So, procurement processes should be based on the project's own characteristics. In this reason, selection of reliable supply vendors is will not only reduce the risks for the other sub-phases of procurement, but will also enhance the stability of the construction plan. An LNG plant has unique characteristics of both a general plant and specialized LNG. It makes more difficulties to select optimal vendors for an LNG plant. The Ministry of Land, Transportation, and Maritime affairs (MLTM) of Korean government described the properties of a general plant as a "complex and technology-intensive system" and a "standard-based industry" that involved "dynamics of plant technology" (2007). These are considered fundamental to project success. In addition, an LNG has more scientific and skillful characteristics, such as "limitation of license to liquefaction", "material corrosion in preprocessing", "low-temperature (-162°C) and high-pressure processes" and "safety problems, such as leakage and explosions" (Jang, 2011; Hong, 2012). These concerns strongly affect not only the material selection and design change but also the weight of criteria for vendor selection. So, to satisfy the above concerns, the supply vendor selection process should be managed carefully with investigation of LNG plant characteristics.

Approaches for Supply vendor selection

According to Monczka et al. (1998), the purposes of supply vendor selection can be summarized as follows: 1) minimize the procurement risks, 2) maximize the value for the customer and 3) establish a long-term and stable relationship. To achieve these aims, Chen (2006) suggests certain guidelines. He emphasizes the criteria

composition based on both qualitative and quantitative perspectives, multiple participants for reducing bias and variability from uncertainty or environmental change. Since the Dickson's research (1966), which suggests the total 23 criteria based on expert survey, many of researches focused on MCDM processes as price, quality, delivery and their service (Weber et al, 1991; Pi and Low, 2009; Chen, 2006). However, most of the literatures focused on the identification of selection criteria over the concerns about quantifications of qualitative criteria. Therefore, previous approaches have limitations in supporting the project manager's procurement decision and management efficiency. Along these same trends, research for construction projects was actively performed. They also suggest the criteria, but some criteria are considered the characteristics of construction projects as past performances and relationships (Ng, 2008; Watt et al, 2010). Nevertheless, this research is limited at the generalization of various expert opinions and the consideration of individual differences in propensity. As a result, existing vendor selection method contained some disputes at the objectivity and rationality perspectives.

FUZZY-TOPSIS–BASED VENDOR SELECTION MODEL

Benefits of Fuzzy-TOPSIS method in LNG plant project

The fuzzy concept was introduced by Zadeh (1965) for making decisions among unclear opinions. It can convert "crisp" contents to "fuzzy (numerical)" languages through the use of "membership functions". It is frequently used to solve MCDM problems in which the problem contains some crisp content. The fuzzy approach yields more realistic results for decision making by eliminating the biases in unclear contents. The Technique for Order Performance by Similarity to Ideal Solution (TOPSIS) was introduced by Hwang and Yoon (1981) to solve MCDM problems. The TOPSIS fundamentally assumed that a Positive Ideal Solution (PIS) exists in the near-to-best solution alternatives and that a Negative Ideal Solution (NIS) exists in the near-to-worst solution alternatives. Therefore, the technique suggests both the best and worst alternatives. Finally, fuzzy-TOPSIS is a combination of the above two theories and was introduced by Chen (2000). He tried to perform decision making using the fuzzy method for linguistic variables and TOPSIS for mathematical calculations. It provided more reasonable and rational results for decision making.

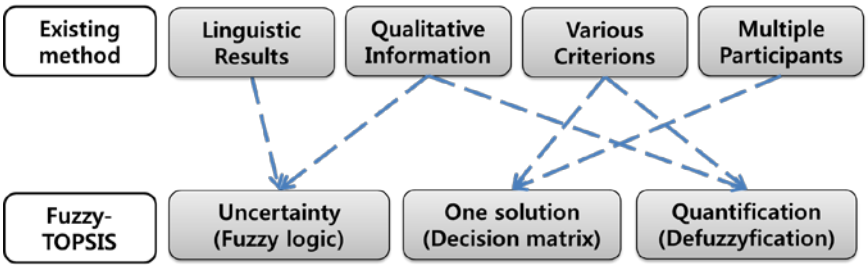

Fig. 1. The Benefits of Fuzzy-TOPSIS Method

According to these characteristics, we identified the benefits of the Fuzzy-TOPSIS method in LNG plant projects (Fig. 1). It can calculate the one solution from complex evaluation results by multiple experts. In addition, fuzzy logic makes various membership functions to minimize the uncertainty and the bias during quantification of linguistic terms. Also, the defuzzification process makes qualitative expert opinions into quantitative evaluation results. Consequently, the fuzzy-TOPSIS is an improved method from the existing models by using the well-structured MCDM process and the

fuzzy logical quantification method. In fact, it can provide a back-up for the uncertainties using membership functions, weighing each criterion and eliminating the bias in vendor evaluation using mathematical matrices to quantify the qualitative criteria using the defuzzification method.

Fuzzy-TOPSIS-Based Vendor Selection Model

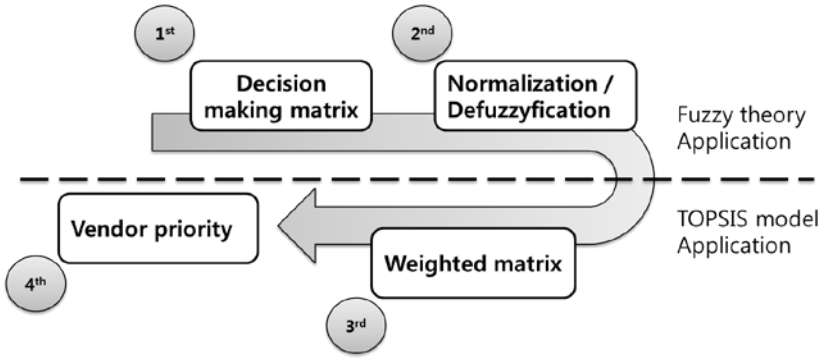

Fig. 2. Flows for the Fuzzy-TOPSIS Method

To establish the supply vendor selection model for an LNG plant considering the above claims, we performed several steps, as shown in figure 2. To choose optimal criteria for supply vendor selection, we performed a broad literature search on decision criteria. Seven studies on frequency analysis were extracted from the literature that focused on vendor selection or vendor evaluation. As a result, four criteria were selected: “price”, “quality”, “delivery” and “relationship (contract experience)”. However, these criteria were focused on general construction projects. Additional criteria must be considered to define the characteristics of an LNG plant project.

$$D = \begin{array}{c} \\ A_1 \\ A_2 \\ \vdots \\ A_m \end{array} \begin{array}{cccccc} C_1 & C_2 & \cdots & \tilde{C}_{n-1} & \tilde{C}_n \\ x_{11} & x_{12} & \cdots & \tilde{x}_{1n-1} & \tilde{x}_{1n} \\ x_{21} & x_{22} & \cdots & \tilde{x}_{2n-1} & \tilde{x}_{2n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ x_{m1} & x_{m2} & \cdots & \tilde{x}_{mn-1} & \tilde{x}_{mn} \end{array}$$

$$W = [w_1 \;\; w_2 \;\cdots\; w_n] \qquad \text{……(1)}$$

The characteristics of LNG plants have already been mentioned as concerns. Comparing these concerns with the four selected criteria, we also extract the additional criterion of “technology ability”. The MLTM method (2007) emphasizes plant technologies and their dynamics. After reviewing the literature, we conducted expert interviews to confirm the extracted criteria. Experts commonly noted that the first four criteria should definitely be considered, and they required additional criteria for “safety” and “maintenance”. If the facility or equipment develops a leak, then a terrible accident could occur. Moreover, the processing resources and products of an LNG plant are flammable. Therefore, safety is more important than the other criteria. Ease of maintenance is suggested by a longer plant life cycle. Finally, we chose seven criteria for supply vendor selection in an LNG plant project (price, quality, delivery, relationship, technology, safety and maintenance). This paper established the use of the fuzzy TOPSIS model for supply vendor selection in an LNG plant project. It

consists of two parts: the fuzzy application and the TOPSIS application. The fuzzy application consists of two subparts. The first step is the development of a decision matrix to quantify the qualitative variables. D is the decision matrix, A_n is the nth supply vendor and C_n is the nth criterion. W_n is the weight of criterion C_n (equation 1).

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \quad \ldots\ldots(2)$$

The second step is the normalization of D. Each criterion has different measuring units. Therefore, the measuring units were unified to facilitate direct comparison using equation 2, where r_{ij} is the normalized value of criterion C_j. Next, defuzzification of the fuzzy matrix is performed. Generally, a fuzzy calculation consists of three phases: fuzzification, fuzzy inference and defuzzification. However, this paper does not use fuzzy inference, which involves a combination of membership functions. In addition, the center of gravity method is used for the defuzzification.

$$z = w_j r_{ij} \quad \ldots\ldots(3)$$

$$A^+ = \max(w_j r_{ij})$$
$$A^- = \min(w_j r_{ij}), i = 1,2,\ldots,n \quad \ldots\ldots(4)$$

The third step is the reflection of the weight on the decision matrix. In this step, the weighted decision matrix is created using the normalized (and defuzzified) matrix and its relative weight (Hwang et al, 1981). Equation 3 shows the calculation of the weighted decision matrix, where w_j is the weight of the jth criteria. Then, a TOPSIS calculation of PIS, NIS and the relative closeness is performed based on the weighted decision matrix z (equation 3). Equation 4 shows identification of PIS and NIS as A^+ and A^-, respectively. To calculate the relative closeness between the ideal solution and weighted matrix, we use the Euclid distance method. Equation 5 shows two of the closeness values; d+ refers to the distance between the PIS and each weighted matrix, and d- refers to the distance between the NIS and each weighted matrix.

$$d_i^+ = \sqrt{\sum_{j=1}^{n} (A^+ - w_j r_{ij})^2}, i = 1,2,\cdots,m$$

$$d_i^- = \sqrt{\sum_{i=1}^{n} (A^- - w_j r_{ij})^2}, i = 1,2,\cdots,m \quad \ldots\ldots(5)$$

The fourth step is vendor prioritization using the results of the TOPSIS calculations. Vendor priority is measured by the closeness coefficient (CCi), as shown in equation 6. CC consists of d values. According to Hwang et al. (1981), the ideal solution of the CCi estimate is one, and the non-ideal solution of the CCi estimate is zero. Consequently, the vendor priority is determined by the scale of CCi.

$$CC_i = \frac{d_i^-}{d_i^+ + d_i^-}, i = 1,2,\cdots,m \quad \ldots\ldots(6)$$

ILLUSTRATIVE CASE APPLICATION

To confirm the applicability of the suggested model, we perform a descriptive case application. It requires inputs for the opinions on each criterion and the relative weights. Then, all of the opinions go to the fuzzy TOPSIS model, which acts as a translator through normalization, defuzzification, PIS and NIS. Finally, the priority of the supply vendor is determined by the CC produced as output.

Table 1. Weight Evaluation of Each Criterion (Sample)

	Price (P)	Relationship (R)	Quality (Q)	Delivery (D)	Technology (T)	Safety (S)	Maintenance (M)
Expert 1	SH	H	H	M	VH	H	SL

A case study was performed using the above procedures. Three experts who had at least 15 years of experience in the LNG construction area, participated in the case study. In addition, they are also currently working on an LNG plant project as managers. Each expert evaluated the relative weight of the criteria using a fuzzy-based, seven-level linguistic scale: very low(VL), low(L), somewhat low(SL), medium(M), somewhat high(SH), high(H) and very high(VH). Table 2 shows the results of the evaluations.

Table 2. Evaluation Results from Experts (Sample)

	Vendor	P	R	Q	D	T	S	M
Expert 1	A	20	2	H	VH	H	M	SL
	B	18	3	VH	SH	VH	SH	SH
	C	16	5	M	SH	M	H	M
	D	25	1	VG	H	H	SH	SH
	E	23	2	H	SH	H	H	SH

Additionally, each expert evaluated five supply vendors using the seven suggested criteria. Price and relationship are not different because we used the same project and product. The above two tables contain all of the inputs. Next, we present the fuzzy TOPSIS calculations. The normalization and weighted decision matrix are calculated based on tables 1 and 2. In addition, the arithmetic mean is used to summarize the various expert opinions. Table 3 shows the calculation results of the weighted decision matrix.

Table 3. Results of Weighted Decision Matrix (Sample)

Vendor	P	R	Q	D	T	S	M
A	0.43	0.26	0.52	0.51	0.84	0.46	0.17
B	0.46	0.39	0.45	0.32	0.72	0.65	0.32

After calculation of the weighted matrix, the CC is determined. To determine the CC, the PIS and NIS of each criterion were calculated by equations y and y, and then the clone values (d+ and d-) were calculated. Finally, the CCs are determined using the closeness values. Table 4 shows the fuzzy TOPSIS results. According to these results, vendor E is the optimal supplier. In fact, vendor E's price is the highest, and the relationship (contract experience) is average. This result would not have been

produced by the traditional approach. Nevertheless, these results reveal that price is only part of the decision; various criteria are crucial to minimize bias. Moreover, these results extract a number of expert opinions through a mathematical approach.

Table 4. Final Results of Vendor Prioritization

Vendor	A	B	C	D	E
CC_i	0.435	0.689	0.686	0.592	0.699
Rank	5	2	3	4	1

DISCUSSION AND CONCLUSIONS

Optimal supply vendor selection is a crucial factor from the project performance and success perspectives. Procurement can account for up to 60% of the total project cost. This paper develops a supply vendor selection model for LNG plant projects. We extracted seven criteria for LNG plant projects through character investigation, expert surveys, and interviews. We then established a supply vendor selection model for LNG plant projects using the fuzzy TOPSIS method. Finally, to confirm the applicability of the suggested model, we performed a case study. According to the case study, the suggested model can enhance the reliability of the decision-making process by proving mathematical evidence. Nevertheless, this approach cannot be directly applied to various real cases. In addition, only three experts participated. These limitations are barriers to the generalization of this study that could be addressed with additional research. However, this paper developed a reliable supply vendor selection model that can be used to summarize a number of expert opinions through a mathematical approach. Consequently, the suggested model can be used as a guideline for making optimal supply vendor selections in LNG plant projects.

ACKNOWLEDGEMENTS

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APPLICATION OF VALUE ENGINERING FOR CONSTRUCTION PROJECTS IN LAGOS, NIGERIA.

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ABSTRACT

Value engineering uses analytical, creative and evaluation techniques on a multi-disciplined basis to achieve the desired functions in a design. The aim of this study is to investigate the use of value engineering process within the construction industry in Lagos, Nigeria. The study was conducted through personal interview and administration of structured questionnaires to selected construction companies, consulting firms and construction professionals who have been involved in the application of value engineering for their projects. The respondents were selected using systematic random sampling technique. The data collected were analyzed using using distributive and inferential statistics. The findings of the study revealed that the packaged review, the truncated workshop, the charette , the concurrent workshop and the contractors change proposal are significantly used in VE study. In carrying out value engineering job plan emphasis should be placed on development phase, implementation phase and evaluation phase. The major challenge of value engineering study is that it is time consuming. The study strongly recommends that value engineering study methods that are in constant use should be examined in details to identify areas of improvement. Efforts should also be made to reduce the time spent in carrying out value engineering study on a project.

Keywords: Construction projects, Cost reduction, Function analysis, and Value engineering

INTRODUCTION

Today many clients are increasingly concerned with the achievement of value for money in their construction projects. In addition, building owners are more conscious not only in cost of construction, but also in the value of buildings in terms of fulfilling its basic functionalities (Lozon and Jergeas, 2008). Providing better solutions or benefits to clients by increasing the value of a project is the foremost objective in the construction industry. Not only the clients but also the project participants are always concerned about project value improvement, but investment capital is a scarce commodity, and clients are striving to use their available capital in the most efficient and effective ways(Hee and James, 2006). In view of meeting these awesome challenges, value engineering came into focus. Value engineering is a process whereby team efforts are made to understand the functions of a system in order to realize the essential functions of that system at the lowest life-cycle cost (Younker, 2003). Value engineering is the systematic application of recognized techniques

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which identify the function of a product or service, establish a monetary value for that function and provide the necessary function at the lowest overall cost (SAVE international, 1998).

According to Palmer, Kelly and Male (1996), Value engineering (VE) developed during World War II in the United States. It began as a search for alternative product components, a shortage of which had developed as a result of war. Due to the war, however, these alternative components were equally unavailable. This led to a search not for alternative components but to a means of fulfilling the function of the component by an alternative method. It was later discovered that this process of function analysis produced low – cost products without reducing quality and after the war, the system was maintained as a means of both removing unnecessary cost from products and improving design. The process of value engineering based on analysis of function was born.

Perera, Hayles and Kerlin (2011) is of the opinion that value engineering is orientated towards providing the best possible product (building) for the client, by providing a process that guarantees that the various personnel involved throughout the entire building life cycle are aware of the needs and functions the particular building must satisfy. This then ensures that these functions and needs can be fulfilled at the most favourable cost, hence providing optimum value for money. Value engineering has become a proactive, problem solving or solution seeking process, which can be used to enhance the functional value of a project by managing its development from design concept to operational use and eventual decommissioning , through structured, team-oriented and open-dialogue exercises, which recommend alternative or confirm existing solutions, and appraise subsequent decisions, by reference to the value requirements of the client (Hayles et al., 2010). Value engineering addresses the key issue of function in relation to cost to achieve maximum value for the client (Hayles and Simister, 2000), providing the client with the means to help ensure that their investment in construction produces a valuable asset, one which is cost-effective to construct, use and maintain. Thus, the emphasis is on functional performance and ensuring the client gets what they need and want from their investment.

Value engineering specifies ways to think about the problem and its constraints, using the concept of value and by identifying what things actually do; their function (Fong, 1999). Value is the relationship between cost and performance: a measure of what is achieved for a given level of effort. In this context, “cost” embraces all relevant costs and functional performance embraces all stakeholder requirements (Kelly et al., 2004). A standard methodology for the application of value engineering has become widely established and it is often referred to as the ‘job plan’. The methodology advocates a systematic approval to the value engineering process. The detail of the “job plan” varies according to the timing within the project and the scope of the value study. At the outset, the job plan is focused on identifying and establishing a balance between competing stakeholder objectives and then throughout a project, the job plan focuses on options appraisal and refinement of design and activity to deliver best value for the clients and other stakeholders (Kelly et al., 2004).Extant literature points to the fact that much research in the area of value engineering process had been done in other parts of the world (Lozon and Jergeas, 2008; Mao et al; 2009; Pulaski and Horman; 2005) and appraisal of value engineering in construction(Palmer et al; 1996; Akintola; 2001) but little research has been recorded in this domain of study in Lagos, Nigeria, hence the need for this study. Within this context, the aim of this study is to investigate the use of value engineering process within the construction industry in

Lagos, Nigeria. Issues identified for investigation included: Extent of usage of value engineering formal methods, significance attached to various phases of value engineering job plan and factors affecting the growth of value engineering in Lagos, Nigeria.

VALUE ENGINEERING PROCESS

A Value engineering process contains three sections, pre workshop, workshop, and post workshop. During the value engineering process, a multidisciplinary team reviews the project plan and assesses the possibility of improving the project value. In the construction industry, value engineering is normally conducted at the early design stage. However, value engineering should not be ruled out at the construction stage as the contractor's practical experience and expertise, innovative construction plan and construction methods, and improved construction logistics management can also lead to substantial cost savings, better quality, and earlier project completion. The key stage of the VE process is the workshop session, which includes information and function analysis phase, creativity phase, and evaluation phase. The creativity phase is the most decisive stage, in which the brainstorming technique is usually applied to generate innovative ideas for enhanced project functions and reduced project costs (Mao, Zhang, and AbouRizk, 2009). The workshop phase are collectively referred to as the job plan. The job plan provides a vehicle to carry the study from inception to conclusion and logically separates the study into distinct tasks. It assures that consideration is given to facts that may have been neglected or overlooked in the creation of the project. Every step of the process is geared toward obtaining a result that increases the ROI (return on investment) or value for the client. Therefore, written documentation is maintained as a record of the process as it progresses. This documentation is formalized into a verbal and written presentation. Success is ensured by adherence to the job plan. The job plan highlights and focuses attention on the pertinent issues, essential needs, criteria, problems, objectives, and concerns of the project. The phases included in a typical value engineering job plan are described in the following.

- ***Goal Definition Phase***—during this phase, the goal is clearly defined and boundaries are established. The purpose is to ensure that efforts are not wasted on non-essential tasks.
- ***Information Phase***—this phase requires the team to capture as much information as possible about the project background and estimated costs.
- ***Function Analysis Phase***—Function analysis forces the team to think in new ways and to think outside the box. Every aspect of the project is described through the use of two word functions (active verb, measurable-noun descriptors) and placing those functions in a decision-logic diagram.
- ***Creativity Phase***—during this phase as many ideas, processes or methods as possible are generated by which the previously defined functions can be performed. This is typically accomplished through brainstorming sessions. No critical judgments or comments are allowed during this phase that might inhibit creative thought. At this phase the focus is on the quantity of ideas not the quality of ideas. At this stage idea such as material substitution, relaxing tolerances, standardizing customized items, combining elements and altering the construction sequence should be considered.
- ***Evaluation Phase***—This is the point in the job plan when the ideas generated in the previous phase are evaluated. The purpose is to assess those ideas that have the greatest probability for implementation. Each idea is examined

individually as to feasibility, cost, and value received. These ideas are tested against the criteria and limitations established in the goal defining phase. In addition, economic analysis, life-cycle cost analysis, tradeoff analysis and sensitivity analysis are performed to better evaluate the value of each idea. Ideas can also be rated on safety, reliability, environmental impact, aesthetics, maintainability and other non-economic considerations.

- ***Development Phase***—the purpose of this phase is to take the remaining ideas from the evaluation phase and develop them into workable value engineering recommendations. The recommendation proposal provides enough information to allow informed decisions to be made. A typical proposal will describe the recommendation, cost of implementing the recommendation, advantages and disadvantages of implementing the recommendation, and supporting data such as sketches, calculations, life cycle cost sheets.
- ***Presentation Phase***—an informal briefing of the value engineering process and results is given to the decision makers. This provides an opportunity to clarify any misunderstandings between project requirements and the value engineering recommendations.
- ***Implementation Phase***—at the client's options any or all value engineering recommendations are implemented. Follow-up may be required during this phase to ensure the recommendation is properly developed by the architect or engineer.

The first hypothesis postulated for this study is: All phases of value engineering job plan as used for VE study in Lagos, Nigeria are not significant.

Value Engineering Methods

There are a number of different methods through which the Value engineering process can be implemented. According to Phillips (2002), the choice of method to use may be dependent upon the type of project and the objectives of the client. The 40-hour workshop is considered to be the most comprehensive implementation of the value engineering process and takes five full working days to complete. This traditional approach to the value engineering process is highly time consuming and expensive, but can provide best results (Kelly and Male, 1993). A shortened version of this process, which some refer to as a "design charette" may be adopted. This generally takes between one and three days to (Kelly et al., 2004) and is the preferred approach as it is shorter and costs less in terms of up front time and resourcing. Kelly and Male (1993) opined that "The Concurrent Workshop" involves the use of a project team under the control of a value manager to review construction alternative on a regular basis during the pre contract phase of a project while "The Contractor change Proposal" is a change inspired by the contractor after the contract has been awarded. The "Truncated Workshop" is used for projects with small contract value and usually consists of a team of six multi- disciplinary members. The "Packaged Review" is commonly used in management forms of contract. This is used where a detailed appraisal of each package (trade or element) is undertaken by the project team as an ongoing process transcending the pre - contract and construction phase of a project. It also involves discussion with specialist contractors and building contractors.

The second hypothesis postulated for this study is that: the various VE methods in use are not significant.

CHALLENGES OF USING VALUE ENGINEERING

Some project stakeholders may perceive value engineering as a critique of their own design by others resulting in negative attitudes and resistance to implementation of value engineering recommendations (Norton and McElligott, 1995; Kelly and Male, 1993; Ellis et al., 2005). Fong (1999) argues that whilst value engineering has grown in popularity, there is still a lack of understanding of the principles of the process amongst some clients and construction professionals. This lack of knowledge can provide resistance to its use, and in the case where it is implemented, the process will not be as successful. Another problem that is common with value engineering implementations relates to timing of value engineering implementation. Ellis et al. (2005), contend that using value engineering at later stages often manifests as a cost cutting exercise rather than preserving or improving value. This perception that value engineering is frequently viewed and applied by some organizations strategically as a cost cutting exercise is shared by Hayles et al. (2010).

RESEARCH METHODS

A mixed mode research methodology was adopted for this study. It involved the use of personal interview to gather broad views of organizations that use value engineering in their construction projects in Lagos, Nigeria. Structured questionnaires were administered to the identified organizations through systematic random sampling technique. The ranges of issues included within the survey instrument were drawn from literature (Perara et al; 2011, Lozon and Jerges, 2008; Palmer et al; 1996).Out of 300 establishments that were identified to have used value engineering technique on their projects, one out of every two establishment were selected and given questionnaires. A total of 94 questionnaires were collected and used for the study. The population sample was drawn from client, consultancy and contracting organizations and this comprises architects, civil engineers, quantity surveyors, builders, mechanical and electrical engineers.

DATA ANALYSIS AND RESULTS

The statistical analysis of the data obtained was carried out with the aid of Statistical Package for Social Sciences (SPSS). Six methods that can be used in carrying out value engineering on a project were identified and used for the study. Responses on the frequency of use of eight phases of the job plan were also sought from the respondents. The respondents were required to rate the frequency of use of each method using 1 for never, 2 for rarely, 3 for sometimes, 4 for usually and 5 for always. And the respondents were required to evaluate the importance attached to various phases of the job plan. The usage and importance index were computed using mean item scores. These scores were then ranked in descending order. The reliability of the survey instrument was tested using the Cronbach alpha reliability test. The Cronbach reliability coefficient alpha is 0.913 with F- statistic of 48.612, $p = 0.0001$ indicating the measuring instrument is reliable at the 5 percent significance level.

Table 1 shows the result of professional status of the respondents. The majority of responses were received from Quantity Surveyors 30(31.91%), this is seconded by Architects and Builders 18(19.15%). Others are Civil Engineers 12(12.77%), Mechanical Engineers 10 (10.64%e) and Electrical Engineers, 6(6.38%). The

responses from quantity surveyors is the highest, this suggests that they are more involved in the practice of value engineering in their respective projects. This corroborates the findings of Perera et al; (2011).

Table 1: Professional Status of Respondents

Professions	Frequency	Percentage (%)	Cumulative Percentage (%)
Quantity Surveyors	30	31.91	31.91
Architects	18	19.15	51.06
Builders	18	19.15	70.21
Civil Engineers	12	12.77	82.98
Mechanical Engineers	10	10.64	93.62
Electrical Engineers	6	6.38	100.0
Total	94	100.0	

The first hypothesis postulated for this study is that all phases of value engineering job plan as used for VE study in Lagos, Nigeria are not significant.
Results in Table 2 indicates that the implementation phase, development phase, function analysis, evaluation phase, information phase, goal definition, presentation and creativity phase have their chi- square calculated values (χ^2 cal =20.65, 18.00, 16.27, 13.45,13.02, 10.67,9.85, 9.81) higher than their chi- square tabulated values (χ^2tab = 3.84, 3.84, 3.84,3.84,3.84,3.84,3.84,5.99), it means alternative hypothesis (H1) which states that all phases of value engineering job plan as used for VE study in Lagos, Nigeria are significant is to be accepted

Table 2: Chi-square test result on Phases of Value Engineering Job Plan

Factors	χ^2cal	DF	χ^2tab	P- Value	Sig	Decision
Implementation phase	20.65	1	3.84	0.000	S	Accept H1
Development phase	18.00	1	3.84	0.000	S	Accept H1
Function analysis	16.27	1	3.84	0.000	S	Accept H1
Evaluation phase	13.45	1	3.84	0.000	S	Accept H1
Information phase	13.02	1	3.84	0.000	S	Accept H1
Goal definition	10.67	1	3.84	0.000	S	Accept H1
Presentation phase	9.85	1	3.84	0.000	S	Accept H1
Creativity phase	9.81	2	5.99	0.018	S	Accept H1

The second hypothesis postulated for this study is that: the various VE methods in use are not significant.

Results in Table 3 indicates that the packaged review, the truncated workshop, the charette, the concurrent workshop and the contractors change proposal have their chi-square calculated values (χ^2 cal =13.42, 12.39 10.17, 7.23,6.39) higher than their chi-square tabulated values (χ^2tab = 3.84, 3.84, 3.84,3.84,3.84), it means alternative hypothesis (H1) is to be accepted for these cases. The 40 hour workshop have their chi- square calculated value (χ^2 cal = 2.47) lower than chi- square tabulated value (χ^2 tab = 5.99) thus the null hypothesis is to be accepted for this case.

Table 3: Chi-square test result on Methods of Value Engineering Job Study

Factors	χ^2cal	DF	χ^2tab	P- Value	Sig	Decision
The packaged review	13.42	1	3.84	0.000	S	Accept H1
The truncated workshop	12.39	1	3.84	0.000	S	Accept H1
The charette	10.17	1	3.84	0.000	S	Accept H1
The concurrent workshop	7.23	1	3.84	0.000	S	Accept H1
The contractors change proposal	6.39	1	3.84	0.000	S	Accept H1
The 40 hour workshop	2.47	2	5.99	0.018	NS	Accept H0

Table 4 shows the summary of the responses to the statements related to factors affecting the growth of value engineering in Lagos, Nigeria. From the results in Table 4, the major factor affecting the growth of value engineering study on projects is that the process is time consuming (0.844), the next in ranking is the process is not implemented early enough(0.804). Others in descending order are: It is more focused on cost and not value (0.776), there is not enough personnel with correct knowledge to carry out the process (0.740); it is costly to carry out value engineering study (0.638) and it is more an assessment of the design teams work. The results in Table 6 is supportive of the findings of Perera et al;(2011) and Ellis et al; (2005) as they suggest that value engineering study is time consuming and the process is not implemented early enough at the design stage.

Table 4: Factors affecting the growth of Value Engineering

Factors	Mean item score	Rank
The process is time consuming	0.844	1
The process is not implemented early enough	0.804	2
It is more focused on cost and not value	0.776	3
Knowledgeable personnel to carry out the process is inadequate	0.740	4
Value engineering study is costly to carry out	0.638	5
It is more an assessment of the design teams work	0.616	6

CONCLUSIONS

This study was set up to investigate the use of value engineering process within the construction industry in Lagos, Nigeria. The test of hypothesis one shows that all the phases of value engineering job plan are significant in VE study. The implication of this finding is that the VE team should not neglect any phase of the job plan. The test of second hypothesis indicates that five methods of VE study are significantly used in Lagos, Nigeria in value engineering study. The study also revealed that value engineering study on a construction project is time consuming and value engineering process on a project does not start early enough during the design process. The study strongly recommends that value engineering study methods that are in constant use should be examined in details to identify areas of improvement. In the execution of value engineering job plan, all the phases of the plan should be taken into consideration most especially the development, implementation and evaluation phases. Efforts should also be made to reduce the time spent in carrying out value engineering study on a project.

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BUILDING CONTRACTORS' SELECTION CRITERIA IN AKWA IBOM AND CROSS RIVER STATES, NIGERIA

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ABSTRACT

This study examines the factors affecting construction contractors' selection in Akwa Ibom and Cross River states of Nigeria. The objectives are to determine the relative importance and consideration of selected criteria for selecting building contractors and to compare the extent of consideration of the factors in the two states. A questionnaire survey approach involving a sample of 72 projects was adopted. Data were collected using structured questionnaires and analysed using relative importance index, relative consideration index and Chi-square test. The result reveals that a multi-criteria method is adopted in the two states to select contractors and that contractors' experience, reputation and quality assurance and control are the hallmark of contractor selection criteria. It is therefore concluded that price is not a major criterion for contractors' selection in the two states. It is suggested that in order for contractors that operate in the two states to be competitive in their bids, they should give more attention to measures that will improve their performance than price.

Keywords: Building contractors, clients, contractors' performance, contractors' selection, Nigeria.

INTRODUCTION

Contractors play significant role in project success therefore, selecting a competent contractor is a challenge to clients. The task is a challenge because the construction industry is volatile, competitive and fragmented (Palaneeswaran and Kumaraswamy, 2000a&b; Fong and Choi, 2000; Mahdi *et al,* 2002). The process of selecting a suitable contractor may involve pre-qualification in which a large number of contractors are invited to submit a technical bid thereafter; some of them are shortlisted based on a set of pre-determined criteria. Hatush and Skitmore (1997a), Ng and Skitmore (2000), Lam *et al.* (2005) opined that pre-qualification process is aimed at minimising the risk of employing incompetent contractors. The next process involves selecting the most competent contractor from those short listed for the contract. The goal of every client is to engage a contractor that will deliver a project at a reasonable cost, to a reasonable quality and within a reasonable time. The most adopted selection methods particularly in public projects over-emphasise the selection of the lowest tender. Hatush and Skitmore (1997b), Fong and Choi (2000), Palaneeswaran and Kumaraswamy (2000a), Mahdi *et al.* (2002) and Banaitiene and

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Banaitis (2006) advocated a balance between cost, time and quality in the final selection of contractors and contended that in selecting a contractor, various criteria such as experience, technical capabilities, performance in past projects, financial strength among others should be considered simultaneously. Banaitiene and Banaitis (2006) opined that some issues that make the existing contractors' selection practice defective include the use of inappropriate criteria when evaluating the qualification of contractors. The duo affirmed that the existing practices contribute to time and cost overruns, variations, rework and failed projects and attributed the weakness in the existing practices to the use of inappropriate criteria such as tender price. In appreciation of this problem, this study examines the criteria used in selecting contractors for the award of building projects contracts in Akwa Ibom and Cross River States of Nigeria. The objectives are to determine the relative importance and consideration accorded selected criteria in the award of building contracts and to compare the consideration accorded the criteria in the award of building contracts between the two states.

REVIEW OF LITERATURE ON CONTRACTORS' SELECTION CRITERIA

Studies on the criteria for contractors' qualification and selection have found that price is the main criterion. However, Holt *et al.* (1995) observed that cost is obviously of prime concern but a balance is desirable between cost, time and quality in order to secure best all round value for money. They suggested that any alternative selection approach should integrate prequalification as part of the selection exercise, introduce a standard secondary investigative element, combine the latter with tender sum to generate a final combined score and identify the optimum contractor. This suggestion calls for a shift from price-based selection criteria to multi-criteria selection approach. Hatush and Skitmore, (1997b) remarked that contractors' prequalification and tender evaluation are decision-making processes that occur within the overall construction procurement strategy and that they involve the development and consideration of a wide range of necessary and sufficient decision criteria as well as the participation of various stakeholders. The duo suggested the use of a common set of criteria (financial soundness, technical ability, managerial capability, safety and reputation) as contractor selection criteria in the construction industry. Hatush and Skitmore (1997a) developed and advocated appropriate predetermined criteria and methods for selecting contractors and discovered that contractors' financial stability, experience, ability and management were perceived to be dominant criteria while contractors' safety and length of time in business were perceived to have least effect. Jennings and Holt (1998) found that experience, financial standing, attribute of key personnel and previous business relationship are important in contractors' selection but that clients attach ultimate importance to low price.

Ng and Skitmore (1999) discovered that a generalised set of decision criteria weighting is unlikely to satisfy both public and private clients and suggested that clients should be allowed to weight criteria in line with their organisational objectives. A conceptual benchmarking model for public sector clients was suggested by Paleneeswaran and Kumaraswamy (2000a). The model identified best practice in contractors' selection using "co-operative" and "non-competitive" approach. The duo described best practices as improved processes or approaches that have produced significantly better results compared to past and current results. In another study, Paleneeswaran and Kumaraswamy (2000b) investigated the assessment of tenderers

on the basis of ten key pre-selection criteria namely: finance, human resources, organisation and management, project specific requirements, past experience, past performance, technology, quality system, health and safety and equipment. The study identified quality accreditation and past performances as useful indicators although; they might not be perfect tools for predicting and guaranteeing better quality performances.

Fong and Choi (2000) contended that the existing selection methods over-emphasize acceptance of the lowest bid and suggested that the use of Analytical Hierarchy Process (AHP) will expose the strength and weakness of contractors. Wong *et al*. (2001) discovered that the construction industry in UK is moving toward a multi-criteria selection approach rather than the lowest-price approach. A Multiple Criteria Decision Support System (MCDSS) contractors' selection model was developed by Mahdi *et al.* (2002) using a combination of the Delphi method and the analytical hierarchy process. The model considered the specific conditions of a project and the capabilities and qualifications of contractors to perform a proposed project taking into account the project specific conditions. The purpose was to reduce the limitation due to individual judgement and increased fairness in decision-making. Topcu (2004) regarded the evaluation of contractors based on lowest tender as a major cause of project delivery problem and proposed a decision model based on multi-criteria approach for contractors' prequalification and choice of eligible bidder.

Although there is a consensus on multi-criteria selection approach in previous studies however, researchers express reservations about the approach because of the importance that should be given to each criterion in contractors' selection in order to achieve fair selection. Lam *et al*. (2005) observed that contractors' selection practices are complicated by subjectivity, uncertainty and consideration of a large number of criteria. Banaitiene and Banaitis (2006) contended that multi-criteria evaluation method may be used but due consideration should be given to clients' priorities. Ng and Skitmore (2000) suggested a transparent process in which the prequalification criteria together with any associated scoring, is made available to contractors. The duo opined that the selection of tenders relies heavily on the use of value judgements by decision-makers and that the experience of pre-qualifiers varies from organisation to organisation. They observed that the use of value judgements is a major source of bias in decision-making and prequalification cannot be exempted.

Studies on contractors' selection tend to attribute the failure of projects generally to contractors' incompetence. However; Elinwa and Joshua (2001) also discovered that factors such as inadequate finance, delay in payment of completed works, frequent changes in materials and design which are not related to contractors' competence contributed significantly to the failure of contractors.

RESEARCH METHODS

The study adopted a questionnaire survey design approach. In the approach, a field survey involving a sample of 72 projects was conducted in early 2011. To obtain the sample, a pilot study of recently completed projects in the study area (Akwa Ibom and Cross River States) was conducted in late 2010. From the survey, 97 projects were identified and adopted as the study population frame.

The variables of the study consist of 25 criteria for contractors' selection which are stated in Table 3. The variables were identified from literature and focus group discussion with the respondents during the pilot study and were measured for

respondents' assessment of their importance and extent of consideration in the award of the contracts of the projects sampled on a 5 point Likert-scale: nil, low, moderate, high and very high. The scale was adopted because it is appropriate for achieving the objectives of evaluating the relative importance and consideration of the factors. The ranks were rated 1, 2, 3, 4 and 5 respectively. To achieve the objectives, a research hypothesis was postulated. The hypothesis states that the ranks of the extent of consideration of contractors' selection criteria in the award of building contracts in Akwa Ibom and Cross River States in Nigeria are not significantly related. The result of the hypothesis is expected to ascertain whether or not the consideration of the criteria used for the award of contracts varies between the two states in Nigeria.

The data were collected using structured questionnaires administered by hand on the project leaders sampled who were engineers, quantity surveyors, architects and project managers. A sample of 72 projects was selected by stratified random sampling from the study population frame. The data were analysed to determine the level of awareness of the criteria by the respondents using Relative Importance Index (RII) and the extent of consideration of the factors in selecting the contractors of the projects sampled using Relative Consideration Index (RCI). Both RII and RCI were derived as the total score divided by the number of respondents. The research hypothesis was tested using Chi-square test.

RESULTS

Characteristics of Projects Sampled

Seven project characteristics were investigated. The results are presented in Table 1.

Table 1 Descriptive results of the characteristics of projects sampled

Characteristic	N	%	Characteristic	N	%	Characteristic	N	%
Project client			**Construction type**			**Project location**		
Private	19	26.4	New	63	87.5	Akwa Ibom State	45	62.5
Public	53	73.6	Rehabilitation	9	12.5	Cross River State	27	37.5
Total	72	100	Total	72	100	Total	72	100
Project duration			**Project cost**			**Project use**		
1-6 months	4	5.6	N1-50m	12	16.7	Office	33	45.8
7-12 months	48	66.7	N51-100m	14	19.4	Residential	10	13.9
Above 12 months	20	27.8	N101-500m	0	0	Educational	17	23.6
Total	72	100	N500m – 1b	7	9.7	Religious	3	4.2
Building rise			Above N1b	39	54.2	Recreational	9	12.5
Low (1-3 floors)	57	79.2	Total	72	100	Total	72	100
Medium (4-7 floors)	9	12.5						
High (above 7 floors)	6	8.3						
Total	72	100						

N=Number of projects sampled, m=million, b=billion

Table 1 shows that the study covers projects procured by both public and private clients and both new projects and rehabilitation works but new projects constitute the majority. On building rise, Table 1 shows that low, medium and high rise buildings were sampled but the majority are low-rise buildings. The results also show that projects sampled are buildings of different uses. The duration of the projects shows that the projects sampled were distributed over short, medium and long durations. The analysis of the value of the projects reveals that the majority of the projects sampled are large projects with value greater than N1 billion. On project location, Table 1 shows that the two states that constituted the study area were covered in the projects sampled.

Assessment of Importance of selected Factors affecting Contractors' Selection

The Relative Importance Index (RII) of twenty-five selected factors that affect contractors' selection stated in Table 3 was investigated. The importance of the factors on contractors' selection was measured on a 5 point Likert-scale as described in the research methods. Respondents indicated the rank that represented their perception of the importance attached to each factor in the award of the contracts sampled. The results are presented in Table 2

Table 2 Ranks of the relative importance and consideration of selected criteria for contractors' selection

Factor	N	Score	RII	Rank	N	Score	RCI	Rank
Past performance	72	294	4.08	5	72	308	4.28	1
Technical staff experience	72	308	4.28	1	72	308	4.28	1
Experience in similar construction	72	305	4.24	2	72	306	4.25	3
Level of technology/technical ability	72	294	4.08	5	72	305	4.24	4
Quality assurance and control	72	302	4.19	4	72	304	4.22	5
Reputation of contractor	72	303	4.21	3	72	303	4.21	6
Tender price	72	282	3.92	10	72	297	4.13	7
Early completion period	72	286	4.00	8	72	287	4.00	8
Plant and equipment	72	290	4.03	7	72	285	3.96	9
Contractor's financial stability	72	283	3.93	9	72	284	3.94	10
Length of time in construction business	72	266	3.69	14	72	280	3.89	11
Contractor's managerial capability	72	282	3.92	10	72	277	3.85	12
Company image	72	268	3.72	13	72	271	3.76	13
Proposed construction methods	72	256	3.56	15	72	269	3.74	14
Safety records	72	269	3.74	12	72	266	3.69	15
Contractor registration category	72	236	3.28	17	72	264	3.67	16
Previous business relationship	72	232	3.22	19	72	257	3.57	17
Reference on contractor	72	235	3.26	18	72	241	3.35	18
Contractor-client previous relationship	72	242	3.36	16	72	236	3.28	19
Current workload	72	229	3.18	20	72	226	3.14	20
Previous records of claims and disputes	72	225	3.13	21	72	221	3.07	21
Contractor-consultants past relationship	72	210	2.92	22	72	213	2.96	22
Familiarity with project location	72	205	2.85	23	72	207	2.88	23
Contractor proximity to project location	72	203	2.82	24	72	191	2.65	24
Company nationality	72	192	2.62	25	72	189	2.63	25

1=Not considered, 2=rarely considered, 3=moderately considered, 4=highly considered, 5=most considered, N=Number of respondents, Score=Total score, RCI=Relative consideration index

Table 2 shows that the importance attached to the experience of contractors' technical staff, contractors' experience in the type of project to be procured, contractors' reputation and contractors' quality assurance and control rank 1st, 2nd, 3rd and 4th respectively. Contractors' technical capacity and performance in previous projects rank 5th while the plant and equipment possessed by contractors, the ability of contractors to complete projects before schedule and contractors' financial capacity rank 7th, 8th and 9th respectively in importance. Contractors' managerial capacity and tender price rank 10th while contractors' safety records, image and length of time in construction business rank 12th, 13th and 14th respectively. Contractors' construction methods, previous relationship with client, contractors' registration category, referees' comment, previous business relationship and current workload rank 15th, 16th, 17th, 18th, 19th and 20th respectively in importance. Contractors' previous records on claims and disputes, previous relationship with consultants, contractors' proximity to project location, familiarity with project location and nationality rank 21st, 22nd, 23rd, 24th and 25th respectively.

Extent of Consideration of Selected Criteria in Contractors' Selection

To evaluate the consideration accorded the selected criteria in the award of the contracts sampled, the extent to which the factors were considered by clients in selecting the contractors that executed the projects sampled was measured on a 5 point Likert-scale as described in the research methods. Respondents indicated the rank that represented their assessment of the consideration accorded each factor in the award of the contracts. The Relative Consideration Index (RCI) of each factor was analysed and presented in Table 2.

Table 2 shows that contractor past experience and technical staff experience rank 1st. Contractors' experience on the type of project to be procured, technical capacity, contractors' quality assurance and control, reputation and tender price rank 3rd, 4th, 5th, 6th and 7th respectively. Contractor's ability to complete projects before schedule, plant and equipment and financial capacity rank 8th, 9th and 10th respectively while contractor's length of time in construction, managerial capacity and image rank 11th, 12th and 13th respectively. Contractor's proposed construction methods, safety records and registration category rank 14th, 15th and 16th respectively while contractors' past business relationship, referees' comment and previous relationship with client rank 17th, 18th and 19th respectively. Contractors' current workload, previous records of claims and disputes and previous relationship with consultants rank 20th, 21st, and 22nd respectively while contractors' familiarity with project location, proximity to project location and nationality rank 23rd, 24th and 25th respectively.

Difference in Consideration of Contractors' Selection Criteria between Akwa Ibom and Cross River States

The study postulated a research hypothesis to compare the extent of consideration of the selected contractors' selection criteria in the projects sampled in the two states. The hypothesis states that the difference in the consideration of selected criteria for selecting contractors of projects located in Akwa Ibom and Cross River states is not significant. The hypothesis was tested using the Chi-square test with $p \leq 0.05$. The rule for the rejection of the hypothesis is that when the p–value>0.05, the test fails to reject the hypothesis but when the p–value≤0.05, the test rejects the hypothesis. The results are presented in Table 3.

Table 3 Chi-square test of difference in the extents to which selected criteria were considered for the selection of contractors of projects located in Akwa Ibom and Cross River states

Criteria	AIS		CRS		x^2	Df	p-value	Diff
	N	RCI	N	RCI				
Technology/technical capacity	45	4.22	27	4.26	6.917	3	0.075	NS
Contractor tech staff experience	45	4.31	27	4.22	1.746	2	0.418	NS
Contractor's reputation	45	4.22	27	4.19	0.476	2	0.788	NS
Early completion period	45	3.91	27	4.11	3.157	2	0.206	NS
Contractor financial capacity	45	3.89	27	4.04	3.677	2	0.159	NS
Quality assurance & control	45	4.33	27	4.04	12.297	2	0.006	S
Contractor's past performance	45	4.42	27	4.04	8.492	2	0.014	S
Proposed construction methods	45	3.56	27	4.04	5.733	3	0.125	NS
Experience in similar project	45	4.40	27	4.00	10.882	2	0.004	S
Construction business experience	45	3.98	27	3.74	5.353	3	0.148	NS
Records of claims & dispute	45	2.73	27	3.63	19.031	4	0.001	S
Contractor's plant & equipment	45	4.20	27	3.56	17.198	3	0.001	S
Contractor image	45	3.82	27	3.56	7.904	3	0.048	S
Contractor's safety performance	45	3.78	27	3.56	5.150	3	0.161	NS
Reference on contractor	45	3.31	27	3.41	5.728	3	0.125	NS

Contractor managerial capacity	45	4.16	27	3.33	19.917	2	0.001	S
Familiarity with project location	45	4.18	27	3.30	11.273	2	0.004	S
Previous business relationship	45	3.73	27	3.22	9.849	2	0.020	S
Contractor current workload	45	3.13	27	3.15	2.766	2	0.429	NS
Contractor-client past relationship	45	3.42	27	3-03	23.588	3	0.053	NS
Contractor-consultant relationship	45	2.31	27	2.92	7.704	3	0.001	S
Contractor registration category	45	3.76	27	2.19	6.615	3	0.085	NS
Proximity to project location	45	3.00	27	2.07	17.910	4	0.001	S
Contractor nationality	45	2.78	27	2.07	5.797	3	0.122	NS

N=Number of respondents, RCI=Relative consideration index, Df=Degree of freedom, Tech=Technical, S=Significant, NS=Not significant.

Table 3 reveals that the p-values for difference in the consideration of contractors' technical capacity, technical staff experience, reputation, ability to complete project before schedule, financial capacity, proposed construction methods, previous experience in construction business, safety performance, referees' comment, current workload, previous relationship with client, registration category and nationality for selecting contractors in the two states are greater than the critical p-value (0.05) therefore, the test fails to reject the hypothesis. The results indicate that the differences in the consideration of the thirteen factors for selecting contractors in the two states are insignificant. However, the p-values for differences in the consideration of contractors' quality assurance and control, past performance, experience in similar project, records of claims and dispute, plant and equipment, image, managerial capacity, familiarity with project location, previous business relationship, previous relationship with consultants and proximity to project location for selecting contractors in the two states are lower than the critical p-value (0.05) therefore, the test rejects the hypothesis. The results indicate that the consideration accorded the eleven factors in selecting contractors of projects located in the two states is significantly different.

DISCUSSION OF FINDINGS

The results of the relative importance of contractors' selection criteria have shown that contractors' technical staff, experience in similar construction, reputation, quality assurance and control, technical capacity, performance in previous projects, plant and equipment, ability to complete past projects on schedule, financial and managerial capacities rank higher than tender price and among the ten most important factors that affect contractors' selection. This result does not agree with the assertion by Jennings and Holt (1998), Fong and Choi (2000) and Egemen and Mohamed (2005) that tender price was considered the most dominant criterion. However, it agrees with the school of thought (Fong and Choi, 2000; Wong *et al,* 2001; Topcu, 2004; Egemen and Mohamed, 2005) that advocated the adoption of multi-criteria for contractors' selection. Incidentally, the respondents did not rate tender price very highly. Contractors-client and contractors-consultants relationships, contractors' registration category, current workload, previous records of claims and disputes, proximity and familiarity with project location and nationality rank among the ten least important criteria. These factors have little impact on quality or workmanship of contractors. The results may be explained by the fact that the two states where the study was conducted are striving to develop or procure world class infrastructures through contracting firms with highly experienced personnel. The fact that the two states are located in riverine areas and high revenue accrues to them from oil revenue may make cost not to be traded for quality.

The study also established that performance in previous projects is the most considered factor when selecting contractors. This result agrees with the assertion by Wong *et al.,* (2001) that the ability to complete projects on time is the most important criteria. Furthermore, contractors' technical staff, experience in similar construction, technology/technical ability, quality assurance and control and reputation are also highly considered above tender price in contractors' selection. There is ample evidence that these criteria are used for contractor selection in Nigeria. The Public Procurement Policy emphasised the use of the criteria and rated them as follows: contractor financial capability (15%), management capability (25%), experience in similar projects (20%), equipment and technology (20%) and annual turnover (5%) (Budget Monitoring and Price Intelligent Unit, 2005). Similarly, Aje *et al.* (2009) also discovered that contractors' technical, financial and managerial capabilities, past experience and health and safety records are the major criteria for evaluating the performance of contractors for civil engineering and building projects during prequalification and tender evaluation in Nigeria. Tender price is discovered to rank seventh in consideration implying that clients give higher consideration to price than the importance attached to it. However, the result tends to indicate that price is not the major criterion for contractors' selection. The results also reveal that contractors' workload, previous records of claims and disputes, relationship with clients and consultants, familiarity and proximity to project location and nationality which rank low in importance also rank low in consideration. This result implies that these factors do not have high effect on contractors' selection.

The test of the research hypothesis indicates that contractors' quality assurance and control, performance in previous projects, experience in similar construction, records of claims and disputes, plant and equipment, image, managerial capacity, previous business relationship and familiarity and proximity to project location are criteria whose consideration in contractors' selection in Akwa Ibom state is discovered to differ from that of Cross River state. This result tends to indicate that the consideration of these factors in contractors' selection in Nigeria is likely to vary from one state to another.

CONCLUSION

The study has examined the criteria for selecting contractors for the award of contracts in Akwa Ibom and Cross River States in Nigeria. This was achieved by conducting a survey. The results have established that first, a multi-criteria method is the approach adopted for contractors' selection in the two states that is several factors are considered by clients in the award of contracts to contractors. Second, the importance and consideration given to the criteria differ from one factor to another. The ten most considered criteria are contractors' technical capacity, staff experience, reputation, records of early completion of projects, financial capacity, quality assurance and control, past performance, proposed construction methods, experience in similar projects and construction business experience. Third, price is not the most considered factors in contractors' selection. The conclusion from these results is that contractors in the two states are not likely to be selected on the basis of lowest tender. Furthermore, the most considered factors are those that concern the performance of contractors rather than his price. The implication of the result is that clients in these two states are likely to give more consideration to issues relating to contractor's performance than his price in their selection. From the conclusion, it is recommended that while contractors that operate in the two states strive to be competitive in their bids, they should ensure that issues that can enhance their performance such as

technical staff capacity, financial and managerial capacities and quality assurance and control are not compromised but given more attention than price. The success of their bids is better enhanced by these factors than by price.

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FACTORS CONTRIBUTING TO UNSUCCESSFUL HOUSING ASSOCIATION PARTNERING ARRANGEMENTS

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ABSTRACT

The challenging economic conditions have forced a reduction of investment into social housing projects in the UK. Housing Associations are therefore striving to minimise waste and optimise value for money. Partnering has been advocated for many years, with Housing Associations subscribing to this procurement method. The success of a partnering arrangement can be significantly impacted by the inadvertent inclusion of factors that inhibit the mechanisms of the partnering ethos. A thorough review of the industry perceived factors that contribute to unsuccessful partnering arrangements has been undertaken in this study. This will enable an empirical assessment of the level of importance placed specifically by Housing Associations on the reviewed factors in future research and in the process contributes to a conceptual model for effective Housing Association partnering arrangements. It is envisaged that this research, upon which this research is based, will assist Housing Associations avoid unsuccessful partnering arrangements through gaining an understanding of the factors that must not be inadvertently translated into a project. The findings provide an evaluation of the barriers that contribute to unsuccessful partnering and highlight the Housing Association characteristics that could exacerbate ineffective partnering.

Keywords: Factors, Housing Associations, partnering, procurement.

INTRODUCTION

Housing Associations were formed to provide quality and affordable rented housing. Housing Associations and co-operatives own and manage approximately 47% of Scotland`s affordable social housing stock. The indicative value of Scottish Housing Association assets is approximately £7.6 billion. Delivering socially owned rented housing is an important function within society. Gibb and Leishman (2011) emphasised the reduced funding available for new build social housing. The former Housing Minister in Scotland, Alex Neil Scottish Government (2010), highlighted to Housing Associations that achieving value for money was an essential element to underpin the future investment programme in housing. In recent times, partnering has

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been advocated as one of the preferred procurement methods for new build and maintenance works commissioned by Housing Associations.

Housing Associations are private organisations however, they are still non-profit bodies who are regulated rigorously by the government. A substantial amount of funding for constructing new dwellings comes from grants provided by the government. These characteristics differentiate Housing Associations clients from their private sector counterparts. A consequence of the thorough regulation is the requirement to demonstrate competitiveness. Fisher and Green (2001) highlighted that if partnering is to be followed, then those charged with public spending need to be equipped with appropriate tools to identify and provide sanctions to protect against anti-competitive behaviour that can result from partnering agreements. Another perceived differing characteristic is that procedures implemented by the public sector can often work against the mutual trust and open relationship, which forms the prerequisite of partnering (Woodrich, 1993). Funding mechanisms also differ between Housing Associations and private sector clients, as tenants' rent and government grants are the drivers for investing in maintenance and new build. Another significant difference is that Housing Associations are not-for-profit bodies, who are committed to providing low cost social housing, as opposed to private sector organisations that may primarily focus on profit. Housing Associations may also be prevented to include within the arrangement a provision to share savings with the contractor (Housing Forum, 2000). According to Burnes and Coram (1999), another barrier is the risk-aversive nature of public sector organisations that is embedded within the ethos.

Despite these inherent characteristics, Housing Associations have been encouraged for some time to utilise partnering arrangements as the preferred procurement method for delivering construction and maintenance projects. The Housing Forum (2002) encouraged Housing Associations to embrace partnering via long term strategic supply chain alliances. The success of partnering is significantly dependent on specific barriers not manifesting into the arrangement. Eriksson et al. (2008) noted that increasing the awareness of the barriers that compromise the success of the partnering arrangement is vitally important. A plethora of research has been conducted to identify the barriers that impact the success of a partnering arrangement within the construction industry generally. There is however limited literature available that focuses on the perceived barriers considered by specific client groups. The characteristics that differentiate Housing Associations from other clients highlight the importance of focussing exclusively on their needs. This research will therefore assess the importance placed on the identified partnering barriers from the sole perspective of Housing Associations. Unveiling the fundamental partnering barriers for Housing Associations will provide guidance on effective partnering and subsequently mitigate the risk of an unsuccessful partnering arrangement, through identifying the barriers relevant specifically to Housing Associations. This could subsequently increase the probability of achieving value for money. Furthermore, the effective utilisation of capital could enable more maintenance and construction projects being commissioned and therefore ease the effects of reductions in investment.

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METHODOLOGY

This stage of the research has been conducted on the basis of an extensive review of the existing literature, based on the general construction industry. Naoum (2007) identified that a literature review attempts to integrate what others have done and said, and criticise previously scholarly works, to build bridges between related topic areas, and/or identify the central issues in a field. The review of literature focuses on the perceived barriers contributing to unsuccessful partnering arrangements. The identified barriers will form an element of a conceptual model for Housing Association partnering. The appropriateness of the reviewed barriers from this stage of the research will be assessed in subsequent fieldwork. Understanding the necessary barriers to be avoided in Housing Association partnering arrangements could mitigate the likelihood of unsuccessful partnering arrangements.

BARRIERS OF PARTNERING

The literature contains a substantial volume of barriers that compromise the success of a partnering arrangement. The following barriers are based on the construction industry generally, without focus on a specific client group. The validity and appropriateness of these barriers will be tested in subsequent research, within a focussed Housing Association context.

Lack of continuous evaluation and improvement

Good practice dictates that the contractor should not be the only responsible party for continuous improvement, as both the client and contractor should work together to maximise the effectiveness of a project. Continuous improvement was identified by Ng *et al*., (2002) as a crucial factor required for a successful partnering project, as it enabled the monitoring of the mutual objectives set by partners, prior to commencing the project. Chan *et al*., (2003) further highlighted that frequent barriers associated with a lack of continuous improvement were approval times and development costs. This is a significant feature of partnering to assess the outcome of implemented arrangements. Housing Associations must ensure that monitoring processes are established to measure performance. Housing Associations must invest resources to ensure the appropriate monitoring techniques are set up and utilised throughout the duration of the project.

Cultural barriers

The culture of partnering agreements embraces the ideology of operating within a spirit of mutual trust and cooperation, advocating a win-win attitude between parties. Ng *et al*., (2002) believed that cultures characterised by conservatism and inflexibility are vital barriers to partnering since as there are limited compromises and team work solutions to action arising problematic issues. Research conducted by Eriksson *et al*., (2008) conclusively identified cultural barriers as crucial to the transition to increasing the level of cooperative relationships between parties. Cultural barriers will be extremely difficult for Housing Associations to surpass. The non-profit nature and need to demonstrate competition by Housing Associations could make it difficult to destroy cultural barriers. However, the construction industry has used traditional and adversarial methods for many years, with many clients continuing to use traditional methods as it is well understood and can provide positive results.

Uneven commitment to mutual objectives

For a partnering project to be successful there is a fundamental requirement for commitment between the stakeholders. A partnering agreement should not be entered unless partners fully commit to the agreement. Research conducted by Akintoye *et al*., (2000) assessed the barriers associated with implementing supply chain partnerships. The research assessed the contractors' perception, and concluded that the most important barrier was a lack of top management commitment. Housing Associations may however find it difficult to fully commit to a partnering arrangement. An example of this could be sharing any cost savings with the contracting partner. A Housing Association could find it difficult to pass any savings back to the contractor, as any savings could be reinvested into more development of properties or upgrading. Housing Associations are non-profit organisations, therefore would seek to reinvest.

Non-inclusion of sub-contractors and suppliers

Partnering arrangements do not only involve the client and main contractor. The majority of works are undertaken by sub-contractors and suppliers. Jones and O`Brien (2003) highlighted that many sub-contractors are small to medium enterprises, and lack the knowledge, expertise and resources to improve performance, without guidance and encouragement from the client and main contractors. The failure to include sub-contractors and suppliers into the partnering arrangement, could result in the theoretical benefits of partnering not being achieved. Including the sub-contractors and suppliers could result in potential cost savings through providing continuity of work over a period of time. The quality could also increase as the sub-contractors and suppliers are fully aware of the client objectives. Housing Associations should incorporate sub-contractors and suppliers when possible, to optimise best value.

Misunderstanding of partnering concept

The ethos of partnering represents a significant divergence from the underpinning philosophies of traditional contracting, which can produce a more adversarial and fragmented nature between the client and contractor. Chan *et al*., (2003) suggested that a thorough knowledge and understanding of the concept of partnering agreements is crucial to form a successful partnering project, therefore if the partners misunderstand the partnering concept, the implementation of the partnering project will be problematic. The research conducted by Akintoye (2000) highlighted that a poor understanding of the partnering concept was the second most important barrier, perceived by contractors, which could result in an unsuccessful partnering agreement. An understanding of partnering appears important, however Housing Associations must be prepared to expend resources on staff training to ensure a comprehensive understanding, prior to initiation of the implementation phase. This could prove decisive and could ultimately dictate the level of value for money that is achieved by the Housing Association.

Discreditable relationship

Partnering arrangements are perceived as providing many positive features for the construction industry, such as more efficient performance, effective communication between parties and more trust between the parties. There is a degree of caution however conveyed by practitioners, as Newman (2000) suggested that the open and trusting relationship between partners, could be abused and perceived as corruption. The reputation of Housing Associations is important, therefore any allegations of corruption could result in a loss of trust of trust from tenants and the Scottish Government taking action to investigate. To counteract this possibility, Longstaff

(2000) suggested employing an independent ethics audit, to create transparency of a partner's ethics and principles. This may be advisable for Housing Associations to protect their reputation, however, would result in further costs associated with implementing the partnering arrangement.

Insufficient effort to keep partnering going

A partnering agreement is not effective upon signing a partnering charter. There is an important requirement for partners to continually work. Larson and Drexler (1997) intimated that partnering agreements could cost parties to ensure an effective alignment of organisations throughout a partnering agreement. In agreement, Chan *et al*., (2003) highlighted that a partnering agreement may require additional staff, resources and time. Housing Associations must carefully forecast the cost of entering a partnering arrangement. The cost of additional staff, resources, time and training must be assessed to identify the feasibility of implementing a partnering arrangement. With extremely low prices being submitted by contractors during the difficult economic climate, Housing Associations may not be able to resist procuring projects on a traditional basis to capitalise on the low prices. The costs to implement and sustain a partnering arrangement could push Housing Associations into utilising traditional procurement.

Inefficient problem solving

Partnering projects that are not effectively implemented, can inadvertently promote the neglect of arising problematic issues, which can escalate, thus compromising the outcome of a project. An empirical study conducted by Ng *et al*., (2002) highlighted that a factor which can result in an unsuccessful partnering project was the neglect of arising issues, which were not rectified at the fruition point, therefore escalated, causing negative outcomes. This could be viewed as a deeper problem, as an effective partnering arrangement should not allow arising issues to escalate, therefore other aspects of the partnering relationship must be failing. The failure to address problematic issues was supported by Chan *et al*., (2003) suggesting that within a partnering project, very often, issues and problems are allowed to slide and escalate. Housing Associations must ensure that arising problematic issues are addressed as quickly as possible to mitigate the escalation of the issue, thus should not compromise the overall success of the project.

Lack of trust and relationship problems

The inclusion of trust is widely recognised as an essential pre requisite of partnering. Akintoye *et al*., (2000) identified trust as the most important factor associated with a successful partnering project. The risk associated with Housing Associations developing trust for the contracting partner is however necessary. The partnering arrangement will not work unless both parties make the effort to trust each other. Albanese (1994) argued that the project environment conducive to trust may be affected by bitter experience in litigation, dispute, and past adversarial relationships. Previous unsuccessful partnering experiences that a Housing Association or contracting partner may have encountered can be remembered and learned from, however cannot be continually referred to within a new partnering arrangement

Lack of continuous open communication

The concept of partnering advocates the continual sharing of information between partners, in an open, honest and timely manner, throughout the duration of a project. Research conducted by Black *et al*., (2000) highlighted that effective communication

was one of the most important factors associated with a successful partnering project. Communication between parties involved in a partnering agreement must be effective, as the needs and expectations of each partner must be clearly understood and recognised. Further research carried out by Ng *et al*., (2002) concurred, highlighting that a lack of open and honest communication facilitated a win-lose attitude, contradicting the partnering ethos. Housing Associations must ensure that effective communication is present within a partnering project, through an open, honest and timely manner, to increase the probability of a successful partnering arrangement.

DISCUSSION

The review of literature highlights an array of barriers that contribute to unsuccessful partnering that are applicable to the general construction industry. This will enable an empirical assessment of the level of importance placed specifically by Housing Associations on the reviewed factors in future research. Barriers such as lack of mutual trust and the failure to effectively communicate appear to be fundamental elements of a partnering arrangement. The critical analysis of the literature did highlight other barriers that could manifest into Housing Association partnering arrangements induced by their defining characteristics. Cultural barriers may be difficult for Housing Associations to resist. Fisher and Green (2001) highlighted that protecting taxpayers from anti-competitiveness in partnering was essential. The non-profit structure and need to demonstrate competition to tenants could make it difficult for Housing Associations to destroy cultural barriers. Housing Associations may also struggle to fully commit to partnering and share risk as according to Burnes and Coram (1999), there is an inherent risk-averse philosophy within public sector organisations, which also applies to quasi-public sector bodies. Another barrier that could impact Housing Association partnering arrangements is uneven commitment to mutual objectives as the current economic conditions and reduced investment from the government (Gibb and Leishman, 2011), may shift Housing Associations priorities and mind set to focus more on their own objectives. The current reduction in investment from the government may also result in Housing Associations not dedicating full effort in keeping the partnering arrangement going as they may be unable to commit the required level of resources to ensure the partnering arrangement is set up and appropriately monitored for a series of projects. The process that could result in unsuccessful partnering for Housing Association is illustrated in Figure 1. The level of importance placed by Housing Associations will be ascertained in subsequent research and will contribute to a conceptual model for effective Housing Association partnering arrangements.

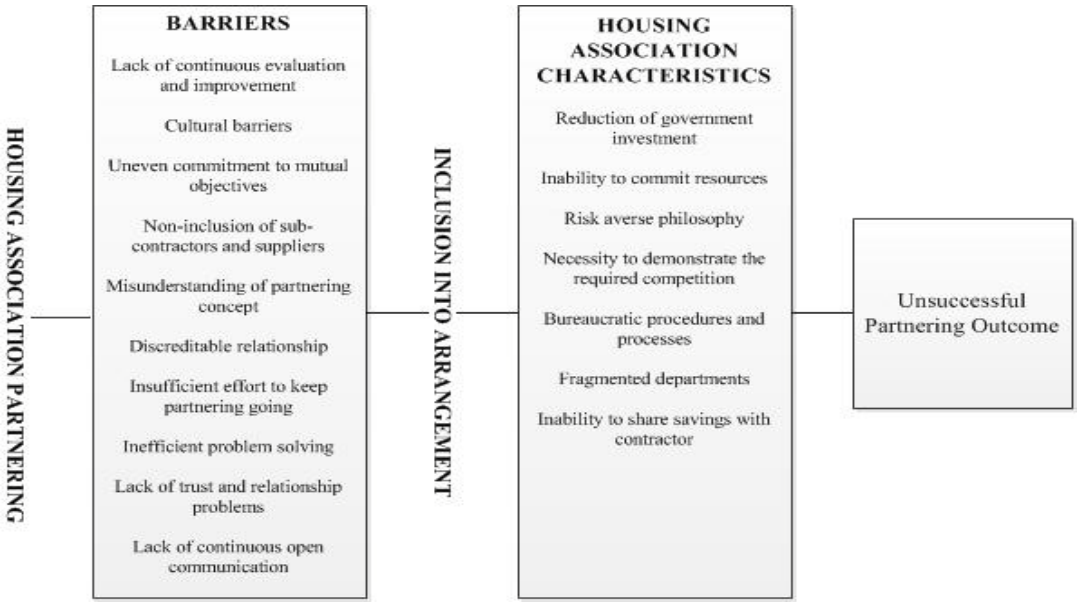

Figure 1 – Housing Association barriers and potential outcome

The evaluation of barriers that contribute to unsuccessful partnering was based on literature associated with construction partnering generally as there is limited literature that focuses on specifically Housing Association partnering arrangements. The factors that differentiate Housing Association clients from private sector clients (Woodrich, 1993; Burnes and Coram, 1999; Housing Forum, 2000; Fisher and Green, 2001), highlights the necessity to establish the essential barriers of partnering for solely Housing Associations. There may be an argument however that these differing characteristics of Housing Association clients could prevent partnering from effectively functioning. The reviewed barriers could compromise the success of a partnering arrangement. It is therefore important that the Housing Association barriers contributing to unsuccessful partnering are identified and avoided to increase the probability of obtaining value for money. The research will address any divergence, in terms of importance between the literature and the view of Housing Associations.

CONCLUSION

Evaluating the literature has identified the barriers that compromise effective partnering. The plethora of previous research lacks focus on specific client groups therefore there was minimal correlation, within the literature, between the barriers and Housing Associations. The reviewed characteristics that distinguish Housing Associations from private sector clients, emphasis the need to differentiate between the most and least important factors that contribute to unsuccessful Housing Association partnering arrangements Understanding these barriers within the context of exclusively Housing Associations, can assist in mitigating the risk of unsuccessful partnering arrangements through identifying the barriers that must be avoided. This will assist the achievement of better value through more effective utilisation of capital invested in construction and maintenance Housing Association projects. The reviewed barriers will be assessed in terms of important in the subsequent research to be conducted to provide guidance to Housing Associations when entering into a partnering arrangement.

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FRAMEWORK FOR MANAGING OUTSOURCING – A LARGE SCALE SERVICES CONTRACT CASE STUDY

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ABSTRACT

Outsourcing has become increasingly important in both the public and private sectors due to its potential to reduce cost and increase efficiency by taking advantage of expertise and economies of scale of specialized vendors. Yet many challenges also exist in managing and implementing outsourced agreements. Included among outsourcing challenges are contractual hazards, poor baseline benchmarks, vendor opportunism, and vendor dependence. Much research has focused on the capability of the external outsourced vendor, while there is less research into the procurement and management processes of the client organization and what role they should adopt within the outsourcing agreement. A case study approach has been adopted to observe and document the outsourcing of a large scale services contract at a public organization via the Best Value Model. Data collection consisted of observations throughout the procurement, planning, and management process with access to the documentation and communication between client and vendor, particularly regarding performance metrics. Lessons learned from this successful outsourcing case are presented to provide a framework for managers and client organizations. This approach and framework has potential to improve outsourcing results. Future testing and continued longitudinal studies are recommended.

Key Words: best value, performance measurement, preplanning, procurement, outsourcing

INTRODUCTION AND LITERATURE

The term outsourcing was first introduced in the 1960s and 1970s in the realm of equipment manufacturing (Corbett, 2004). In the current marketplace, companies outsource a virtually boundless variety of products and services, from cleaning to catering to business processes to information technology management (Engardio et al., 2006). The growing trend of outsourcing stems from the common belief that specialized private companies can assist other organizations to save money and improve efficiency in the client's non-core tasks by utilizing their expertise to perform services faster and cheaper (Russell 2010).

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The need to foster successful outsourcing relationships has become critical, and much research has been focused on the client outsourcer's perspective of identifying the outsourced vendor's capabilities (Perunovic *et al*., 2012). This has resulted in claims that vendor capabilities are one of the most important factors in the success of outsourcing (Levina and Ross, 2003). Sako (2010) called for more research to explore what client organizations need to consider in order to make the outsource relationship a success. The process and role of the client organization in aligning with external vendors has been subject to less research, a topic this paper will explore in more detail to develop a framework of practices for the outsourcing organization to undertake to improve outsourcing success. A case study approach was utilized to examine the outsourcing process undertaken to procure, plan, and deliver a large scale services contract within a public organization. Based on lessons learned and contract results, a framework of management practices is proposed to assist outsourcing efforts.

Benefits of Outsourcing

When managed correctly, outsourcing can achieve greater efficiencies, improved service performance levels, and reduced costs (Davis, 2005). Studies show that the mechanism by which outsourcing can allow organizations reduce costs is through process standardization and economies of scale (McIvor *et al.*, 2011). A recent study by Accenture confirmed that almost half of the businesses surveyed have found outsourcing to be the leading supply chain reform that saves costs ("IT Spending Still Strong," 2001). Many public organizations have turned to Privatization Task Forces to review opportunities within state and local government. Cost savings in the hundreds of millions of dollars have been reported via outsourcing in the states of New Jersey and Pennsylvania as well as the City of Chicago (Russell, 2010).

Challenges of Outsourcing

Outsourcing does bring certain challenges. The risks most commonly associated with outsourcing include: contractual hazards, excessive dependence on a single vendor, knowledge loss, performance measurement difficulties, and vendor opportunism (Currie *et al*., 2008; Handley and Benton Jr., 2012, Feeny *et al.*, 2005). Benchmarking is critical to establish a base line level of services to show the client organization how good they are at running services internally, yet it is often difficult to accomplish or is ignored (McIvor *et al.*, 2011). In fact, most outsourcing organizations do not have metrics in place before they decide to outsource a service. "The problem is that outsourcing deals are really about risk," says Adam Strichman, co-founder of Sanda Partners, an outsourcing consultancy. "You're taking the risk of the unknown and dumping that on your supplier," he says. "You're outsourcing a problem to a company that has limited control over the root cause of the problem." (Russell 2010).
These challenges make the role of business and procurement professionals a key factor of success in managing and implementing outsourced (Dickens Johnson, 2008).

RESEARCH DESIGN

A case study approach was selected for this research study to observe and document results in the outsourcing of a large scale services contract in a public organization. The case study method was selected because it enables greater access to data and enables researchers to analyze relationships and management processes. The researchers applied a longitudinal approach with the outsourced contract being

analyzed for a period of more than two years. Researcher involvement began more than a year prior to the contract being signed, which provided significant involvement and insight into the procurement and planning of the outsourced agreement. The researchers participated in the agreement directly as educators to assist the client in implementing the Best Value Model (Kashiwagi, 2012), a value and risk based procurement system and implementing a formal preplanning process *prior to* finalizing and signing the contract. The researchers also aided with establishing performance measurements to define the baseline proposal and monitor service levels during the first year of the contract.

The outsourcing organization in this case study, Arizona State University (ASU), was selected for multiple reasons. Preliminary discussions with management and key personnel revealed the complexities and challenges in moving towards an outsourced solution and establishing a successful agreement. The topic of outsourcing – book store services at all four ASU campuses – represented a large scale contract in a complex and rapidly evolving industry that has been increasingly impacted by technology in the form of online textbooks, rental texts, e-books, and social media marketing strategies. Involvement in such a complicated project was anticipated to result in important insights and learning that would help develop a framework for successful outsourcing practices. Furthermore, the research team already had strong relationships with ASU, which enabled greater involvement in the project. This made it possible to gain access to key personnel who were involved in the project from initial formulation to full implementation. This perspective enabled performance level comparisons between the original status quo service operation and the resultant value delivered in the outsourced agreement.

The primary source of data collection was via access to the documentation and communication between client and proposing vendors during the procurement process. Data sources included Request for Information (RFI), baseline performance metrics, Request for Proposals (RFP), Vendor Submittals and Financial Proposals, Selection results, and preplanning documentation. The research team analyzed the data to determine the optimal outsourcing arrangement and to determine common factors and key lessons learned to develop a framework. Follow-up data collection and analysis occurred after the first full school year of book store operations to understand the level of service delivered.

CASE STUDY BACKGROUND

Prior to outsourcing, the client organization operated and managed all book store services internally. ASU directly owned the book stores on campus and all sales revenues were directly re-circulated within the university. Due the large size of the university, ASU has four separate campus locations within the Phoenix metropolitan area, each of which is home to its own book store. Although ASU was satisfied with their current book store operations, the rapidly changing landscape of the book store industry created motivation to seek an understanding of current market capabilities to deliver increased value. ASU determined to investigate outsourcing options to compare against their status quo operations. The intent was to identify a company with the expertise to be a leader in the book store management field and offer a best practices approach to implementation and delivery for years to come.

PROCUREMENT AND PLANNING OF OUTSOURCED AGREEMENT

A major challenge for the client in procuring book store services was an incomplete understanding of what information to provide to prospective vendors. The client determined that comprehensive and accurate proposals were deemed necessary to ensure project success. Yet, as is commonplace during the initial stages of the outsourcing process, the client desired world-class service levels but was unsure of how to achieve this result. To address this issue, the client's first step was to solicit a Request for Information in order to find out what information vendors required to be able to propose in an effective manner. The result was a wealth of information requested by the prospective vendors which the client then included within the scope of services for their Request for Proposal. The RFI information requested by vendors included current financial information, existing sales policies, technology sales arrangements, current and projected sales volumes, commission structures, personnel information, facility conditions, capital investment plans, other external factors and initiatives that may impact future service levels. These metrics helped the client formulate a detailed and informative scope of work that ultimately resulted in accurate proposals and became the first attempt to align baseline performance measurements.

During the RFP process, the client incorporated principles of the Best Value Procurement Model by making the assumption that each vendor had the expertise to provide book store services that fulfilled the minimal needs. Instead of focusing on this minimum expectation, the client allowed the vendors to compete based on value and their ability to maximize the client's satisfaction. The submitted proposals were asked to be brief, show differentiation, and allow ASU to make a data-based decision on which firm is the best value vendor for the client.

The RFI process not only enabled the client to develop an accurate scope, but also resulted in recommendations of various service options that the vendors could propose on. The resultant RFP was composed of three financial proposal options: the first two were defined by the client and had differing potential conditions regarding financial structures and personnel requirements. The third option was left completely open to the proposing vendors to develop the most advantageous cost proposal according to their preferences and expertise. This was consistent with core philosophies of the Best Value Model, which strives to minimize risk by better allocating project risk and responsibility to expert vendors. This third option, which was essentially a "vendor-generated solution," was ultimately the option accepted by the client to partner with the selected vendor. Although interesting, it may not be completely surprising that the vendor-generated solution was the most advantageous, since the whole point of outsourcing is to align experts to deliver a service that is a non-core activity for the client.

Structured Preplanning for Outsourcing Transition and Operation

The selected vendor was then brought forward into the Best Value Clarification Period, which is a formal preplanning process that occurs prior to the final award being made. This is different from more traditional procurement functions, where the procurement process narrows the selection to one vendor and then directly enters into a contract. In the Best Value process the potential vendor is asked to clarify their

proposal and the metrics and measurements become part of the contract, which was found to be extremely valuable in an outsourcing scenario.

The Best Value preplanning process centered on clarifying the proposal, addressing client concerns, establishing a transition schedule, finalizing service baseline numbers and future projections, and establishing performance measurements to track service levels during execution. The selected vendor entered the preplanning process with a detailed plan and immediately engaged the client in discussions about the transition schedule to set up and commence outsourced services. These topics not only served as further demonstration of the vendor's ability to accomplish the job, but also resulted in further clarification of the client's baseline performance metrics of their current and past levels of service as provided internally. Based on this information, the vendor identified the original commencement date of services, as dictated by the client, to be a significant risk. The vendor instead proposed moving the original start date to occur before the beginning of the next semester. The client yielded to their expertise, assisted in providing all needed information to make the transition seamless, and ultimately the book store opened up on schedule.

RESULTS AND DISCUSSION

The application of the Best Value Model to outsourcing a large scale services contract was found to be highly successful. The first major success came from the RFI process which aided the client organization in understanding how to develop a scope of services that detailed enough to enable outside vendors to (1) understand the current benchmark of performance within the client organization, (2) craft a financial proposal that was optimal for both partnering organizations, and (3) identify existing opportunities for improvement. This was advantageous to project success because it saved considerable time during the transition phase where the client went from running all book store services in-house to releasing full control and management of operations to the outsourced vendor.

Coupling the Best Value procurement and preplanning processes had a significant beneficial impact on achieving a smooth transition to outsourced services. The vendor was able to enter the client's environment, clarify necessary details, present their plan to client managers and personnel, and then transition into full operations before the start of the next semester, which was a critical milestone date. In fact, the process was so successful that zero percent transition delays were encountered, which was remarkable for such a large scale outsourcing across four separate campuses.

After the first year of operations, the outsourced contract model was a documented success. Not only did the contract deliver significant monetary value to both client and vendor (while simultaneously eliminating client management responsibilities), but end users also felt the impact of increased service levels the expert vendor was able to maintain. As a part of their performance measures, the vendor ran numerous customer service surveys and compared results against their company-wide benchmark of 88 percent customer satisfaction. Annual results showed an average level of customer satisfaction to be nearly 93 percent across all four campuses, which was nearly a full five percent improvement over the established benchmark. Full results are shown in Table 1.

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Table 1: Increased Customer Satisfaction with Outsourced Book Store Services

Service Area	Customer Satisfaction	Improvement over Company Benchmark
Campus 1	94.9%	+ 6.9%
Campus 2	96.3%	+ 8.3%
Campus 3	91.6%	+ 3.6%
Campus 4	89.1%	+ 1.1%
Average	92.97%	+ 4.97%

Framework for Outsourcing

Lessons learned from the success of the presented case study have resulted in a framework of key outsourcing practices for clients and managers to consider before beginning the outsourcing process.

Engage the vendor community to develop potential service level agreement options.

Providing a clearly defined proposal and established project objectives is critically important to gain proper alignment of parties in an outsourced agreement. Since the vendor community has greater expertise in the specific field in question, they may also have a better understanding of the required details and potential agreement options that will maximize success. Engaging with potential vendors will enable the client to gain ideas, explore various sourcing options, and create an accurate scope. Utilizing a Request for Information was shown to be highly successful to help the outsourcing organization to develop a detailed and accurate scope of services, which enabled responding vendors to provide accurate costing and delivery plans.

Align expertise via vendor-generated solutions.

Clients may benefit from including a vendor-generated solution option within their Request for Proposal. This practice allows full freedom for vendors to utilize their expertise and propose the most advantageous agreement possible. Benefits may be realized due to innovative financial structures or by improved performance propositions.

Measure the client organization's baseline performance.

A critical part of outsourcing is to accurately define the current level of performance within the client organization. Not only does this help create more effective proposal responses, it also provides greater potential for project success by facilitating more effective planning efforts to minimize transition delays and optimize long term performance. Vendor involvement may be necessary to determine what specific measurements are needed, and several iterations may occur before the full baseline performance metrics are established. In the presented case study, the types of baseline metrics required were uncovered via vendor feedback to a Request for Information, actual measurements were presented n the Request for Proposal, and the final current baseline metrics were clarified within the preplanning process. Performance metrics that should be considered include:

- Current financial structures (commissions, profit margins, etc).
- Existing sales and service policies.
- Current and forecasted service levels and volumes.
- Existing facility conditions, capital investment plans, technological support.

- Personnel, staffing, and benefits.
- Specialties and external conditions within the client's environment that may impact the service level or execution.

CONCLUSION

The option of outsourcing non-core business functions to external vendors has the potential to add significant value to client organizations. Yet procuring, establishing, and maintaining a successful outsourcing relationship has long been met with a series of challenges and oftentimes both parties – the client and outsourced vendor – are left frustrated or unsatisfied with less than optimal results. This paper aims to provide a framework of advantageous practices to aid client organizations that may seek an outsourcing effort. A case study of a successful outsourcing arrangement was presented, the process utilized was discussed, and resulting performance levels shown. The success of the Best Value Model has the potential to be useful in outsourcing large scale service contract. Further testing of the model is needed as well as long-term measurement (longitudinal studies over a period of years) of outsourcing success on individual contracts such as the presented book store case.

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IMPACT OF PREPLANNING ON CONSTRUCTION PROJECT SUCCESS: PRE-CONTRACT PLANNING CASE STUDY

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ABSTRACT

Maintaining competitiveness by increasing performance is an ever-present goal in the construction industry, yet project performance has remained relatively stagnant and schedule slippages and cost overruns continue to plague the construction stage. A growing sentiment exists that these problems may be best addressed before the construction phase commences, prompting investigation into improved pre-construction and project planning approaches. The best value business model incorporates a formal preplanning process that has been tested recently in the construction industry and has been documented to produce favourable results. The best value planning process is based on four primary methods: (1) project planning is done before signing the contract; (2) identification and alignment of expertise; (3) transference of project responsibility and accountability to the contractor; and (4) emphasis on planning supply-chain interactions rather than technical aspects. Lessons learned are shared from implementing this process at the University of Alberta on a high profile $21 million design build project for a high tech research facility. Significant cost savings, minimized schedule impacts, and optimized coordination of the construction stage were documented. Case study results are encouraging and suggest that this pre-contract planningapproach may be a viable consideration in the construction industry.

Keywords: alignment, best value, planning, preconstruction, risk management.

INTRODUCTION

Effective planning leads to enhanced project performance, resulting in benefits such as cost and time savings, clear scope definitions, and the reduced occurrence of change orders (Gibson *et al.*, 2006; Haponova and Al-Jibouri, 2009; Yates and Eskander, 2002). Shapira *et al.* (1994) defined planning as "the process of deciding what to do and how to do it before action is required." Verheij and Augenbroe (2006) treated project planning as the coordination of interconnected "dialogues" or decisions between project partners that are established into a formal plan. Research has linked poor planning to delays, cost overruns, and owner dissatisfaction (Casinelli, 2005).

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Contractors and project owners alike are significantly impacted by such occurrences (Ndekugri *et al.*, 2008). Numerous reports and research studies indicate that the majority of construction projects experience delays, oftentimes a direct result of poor project planning (HMSO, 1995; OGC, 2003; Casinelli, 2005). Gibson *et al.* (2006) noted that many organizations lack the expertise or the drive to thoroughly perform preplanning tasks.

LITERATURE

Preplanning activities occur at various stages in the project lifecycle, wherein the planning processes in each stage are comprised of different goals, stakeholders, degrees of certainty, and levels of detail. Distinct planning processes typically occur at four different periods in the project life cycle: Preproject, prebid, preconstruction, and during-construction.

Preproject Planning is the initial planning process undertaken by the project owner, designer, and consultants. Activities include all tasks between project initiation and the beginning of detailed design (Gibson *et al.*, 2006). Chang *et al.* (2010) found coordination issues between contractor and design as the main problem hindering performance in this stage.

Prebid Planning is primarily a contractor activity to plan general actions in project execution and takes place prior to bid submission.

Preconstruction Planning expands from when a single contractor is selected or awarded the bid up until a certain point within the construction process. This stage traditionally occurs at no more than one month before mobilization and no more than two additional months beyond mobilization (Laufer *et al.*, 1994).

During-construction Planning consists of all activities beyond mobilization and completion of preconstruction planning.

This research presents a unique preplanning model that occurs prior a contract being signed between the owner and contractor. The planning process transpires post selection and before mobilization, which relates closest with the traditional method of preconstruction planning. This paper focuses on the preconstruction stage of the project lifecycle (however, the presented preplanning model is recommended to be linked with prebid planning and extend into during-construction planning). Preconstruction deliverables traditionally include a detailed front-end schedule, baseline milestone schedule, risk management process, operational work plan, and a clear scope (Casinelli, 2005; Hassanein, 2005; Laufer *et al.*, 1994).

The presented planning model is process-oriented and emphasizes coordination between the various project stakeholders. A process-oriented planning process is recommended by numerous research studies, mainly due to the importance of addressing project team alignment (Haponava and Al-Jibouri, 2009; Hastak *et al*., 2008, Griffith and Gibson, 2001). Alignment, which is recognized by the Construction Industry Institute as a best practice for project planning, leads to heightened project performance and is defined as “the condition where appropriate project participants are working within acceptable tolerances to develop and meet a uniformly defined and understood set of project objectives” (CII, 1997). One reason that alignment is so important is stated by Haponava and Al-Jibouri (2009), whose research showed that contractors unanimously agreed that clients are on different levels prior to beginning the construction process. Defining the client’s environment

and managing their requirements becomes critical to align the different levels present on a project. A research study of seven construction project case studies identified alignment as the most frequently employed CII best practice that was responsible for radically reducing project cycle times by greater than 25 percent (Hastak *et al.,* 2008).

BEST VALUE PREPLANNING MODEL

The Best Value Model is an owner-driven, quality-based system of contract procurement and execution, and includes models for Procurement, Preplanning, and Contract Management (Sullivan *et al i.,* 2009). The Best Value Preplanning Model is a process-oriented methodology that transpires prior to contract execution. The Best Value Preplanning Model is owner-facilitated, contractor-driven, and aims to establish a complete project plan before project work begins. This model was originally developed at the Performance Based Studies Research Group (PBSRG) at Arizona State University (ASU) and has been tested on more than 900 projects totalling more than $4.7 billion in procured services and construction. In construction, the preplanning methodology has been tested on capital projects and renovations, over a wide range of scope requirements, and within multiple delivery systems (including design build, construction manager at risk, and integrated project delivery with value-based selection). PBSRG has assisted many owners in the public and private sectors to implement the Best Value Preplanning Model, including the University of Minnesota, Rochester Public Schools, Idaho Transportation Department, State of Alaska, State of Washington, University of New Mexico, U.S. General Services Administration, City of Peoria, and University of Alberta.

Improving Planning Impact Through Alignment and Transfer of Risk

The construction industry has had a difficult time in standardizing preplanning processes due to highly diverse deliverables. Furthermore, owners have difficulty differentiating contractors based on quality and value, which has resulted in selection methodologies that predominantly consider price (Sturts and Griffis, 2005). The price-based market has placed greater significance on non-value adding activities, such as increased owner management, inspection, and quality control (Seppala, 2004). The Best Value Preplanning Model aims to improve project performance by aligning all stakeholders within the construction project team utilizing the following methods:

Pre-Contract Planning. The timing of the Best Value Preplanning Model is unique when compared with traditional industry practices in that it occurs prior to signing the contract. The planning process begins following the procurement selection a single contractor, who is then brought forward into a pre-contract planning relationship. The selected contractor is responsible for establishing a full project execution plan, coordinating with owner stakeholders, generating a clear scope definition, establishing a full project milestone schedule, documenting a risk management plan, and receiving owner signoff on all functional plans prior to the contract.

Project Level Role Reversal. The current price-based market has seen owner decision making, inspection, and management increasingly drive project activities, yet the idea of the owner hiring a contractor for their expertise and then directing them how to operate inherently lowers efficiency (Sullivan, 2011). The Best Value Preplanning Model seeks to minimize unnecessary owner activity by placing responsibility on the contractor to plan the delivery process and quality controls. The contractor effectively becomes the hub for all coordination, documentation, and dissemination of critical

information with regards to project execution. Redundant management is thus minimized, and the owner's role becomes one of facilitating the contractor's efforts by providing any needed resources or information relating to project delivery.

Supply Chain Mentality. During preplanning, the contractor is asked to plan the entire project delivery and create a risk management plan that identifies risks to the plan. The focus of the risk management plan is on risks that are not under the contractor's direct control. This forces the contractor to operate with a supply chain mentality to identify and minimize project risk at the points of interaction and coordination between various project stakeholders. Such risks are identified and prioritized, aan action plan is created to minimize the risk from occurring, and a step-by-step response plan is generated for if these risks do in fact occur. All stakeholders approve the plan before signing the contract, which leads to a clear understanding of each party's roles and responsibilities, thus achieving proper alignment.

Transfer Risk to the Expert. Project responsibility and accountability is better allocated to the contractor by making the risk management plan a part of the contractor's contract. This enables the contractor to define its role on the project by identifying what risks are outside its control and accepting responsibility for all other foreseeable risks. During the project, it is understood that the contractor becomes the coordinating hub of all project activities. The contractor is responsible for documenting and distributing critical information about unforeseen risks that impact the project schedule, budget, or owner expectations of performance. The contractor is also held responsible for final project outcomes. Upon closeout, the owner gives a formal satisfaction rating of the contractor's performance, which then impacts the contractor's qualifications should they bid on future projects with the same owner.

Pre-Contract Planning Methodology

According to the above-mentioned principles, the Best Value Preplanning Model is process-oriented in that it is stresses optimal coordination of the various parties involved in project execution. The specific details of the operational plan are left to the experts – the contractor project team – but any necessary interactions between parties are clearly indicated in the plan. This coordination between parties is essential to communicate expected roles and responsibilities, which serves to minimize confusion and prevent project tasks from "slipping through the cracks." The process results in a fully detailed project plan prior to construction. Note that this does not necessarily mean that *every* issue has been completely resolved prior to construction, but it does require that the operational strategy is set and a specific action pathway has been coordinated with and agreed to by all participating parties. The Best Value Planning Model consists of six general steps:

Step 1: Process Education. The owner and related consultants provide educational resources for the selected contractor regarding the philosophy of the process, expected deliverables, and agenda of the initial kickoff meeting

Step 2: Kickoff Meeting. The contractor directs the meeting by presenting an overview of their project plan, discusses major risks and solutions, and sets the schedule of activities for the preconstruction planning period.

Step 3: Plan & Coordinate Deliverables. All required coordination activities are conducted to determine details of the project plan. This step has the longest

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duration, and consists of meetings with specific owner stakeholders to provide needed information and requirements to the contractor's project team.

Step 4: Insert Deliverables Into Contract. The final functional plan is written in a formal manner and included in the contract documents. The plan includes the project scope (centered on interaction points between project participants), risk management plan, milestone schedule, financial agreement, and performance metrics.

Step 5: Summary Meeting. This meeting serves as a formal, final check that all parties agree to the plan before signing the contract.

Step 6: *Contract Signed.* Once all parties agree to the plan presented in the Summary Meeting, the contract documents are finalized, compiled, and signed.

ADVANTAGES OF PRE-CONTRACT PLANNING

While formal preplanning efforts that occur prior to the contract are uncommon within the industry as a whole, there are several key benefits of adopting this method. After years of testing, the following benefits have been documented to positively impact project performance.

Product Definition. By planning the entire project before entering into a contractual agreement, the owner and contractor both develop a clear understanding of what will be delivered. If at any point the contractor is unable to complete the preplanning or adequately resolve client concerns, the partnership may be broken. Yet if the contractor is able to complete the preplanning and both parties are inclined to continue with the project, the contract is signed. This results in an alignment of expectations, which is critical to project performance because the owner has a clear understanding of what they will receive and the contractor defines all project roles.

Heightened Accountability. After the contractor defines the contract in their risk management plan, they are measured against the plan throughout the project lifetime. The Best Value Model institutes a weekly risk reporting system wherein the contractor is responsible to identifying, documenting, and communicating any deviations to the plan. Impacts to the contract are documented in terms of budget, schedule, or owner expectations of performance.

Alignment. The roles of project participants are clearly defined during preplanning activities, placing the majority of risk and responsibility for delivering the project at the hands of the contractor. The contractor is also asked to define owner responsibilities by creating an "owner action item list" and planning a schedule that shows and owner key decision and input points over the project lifetime.

Increased Due Diligence. Holding planning activities prior to the contract forces greater due diligence. The contractor is driving towards signing a contract, which is only awarded once the project execution plan is in place. This inherently provides greater motivation to conduct a formal and thorough planning process.

LIMITATIONS OF PRE-CONTRACT PLANNING

Some weaknesses and limitations do exist in a model where the preplanning process occurs before the contract is signed.

Contractor Hesitance With Role Reversal. Even with training resources available to assist contractors in making the switch from traditional processes to a pre-contract

planning model, hesitancy may exist in bringing risks to the owner's attention. As the contractor dives into the project details and coordinates with client stakeholders, it is not uncommon for them to identify new risks or discrepancies that were not apparent in the bidding process. As the expert party, Best Value expects the contractor to identify any such risks, determine the optimal mitigation strategy (or strategies), and communicate potential impacts to the owner. Yet contractors can at first be uncomfortable with this role and unsure of how to communicate risks to the owner.

Tendency to Rush. Since the contract is not officially awarded until after the Best Value Preplanning Model is completed, contractors may attempt to speed the process up to secure the contract, which may result in shortcuts, loose ends, and non-specific risk mitigation strategies. Proper owner facilitation minimizes this limitation.

Educational Requirements and Resistance. Owners underestimate the amount of time and energy required to achieve a successful pre-contract planning process. Even if the owner has run the process many times, it should not be forgotten that the contractor group may be experiencing it for the first time and thus need significant support. Employee and contractor personnel resistance to change also exists. For the Best Value Model to work, all parties must be properly educated of the process, their roles, the expectations, and the overall purpose of the efforts.

Determining Completion. Determining when the preplanning process is complete and the partnership should move forward to contract may be unclear. The contractor, or even factions within the owner's group, may push to sign the contract. Yet before the contract should be signed, the plan must include a fully developed risk plan, clear scope definition, execution plan for delivering the scope of work, a milestone schedule (often with clear detail of what will be done in the first 30 to 90 days), and a client action item list (with all the information and support needed by the contractor). Both parties should review and agree to all parts before signing the contract.

Lack of Compensation. Contractors may be reluctant to spend too long a period of time working on preplanning activities in a situation where they have no cash flow since no contract has been signed. The owner must be sensitive to this aspect on a project-to-project basis. For highly complex projects that may required an extensive planning process, a source of funding may in fact be needed (this has been most commonly seen in selecting design consultants who submit detailed renderings).

PRE-CONTRACT PLANNING CASE STUDY

The Best Value pre-contract planning model was implemented with impressive results on a $21M design-build (DB) project for an advanced laboratory facility at the University of Alberta in Edmonton, Canada. The scope was for the repurpose of a cold storage facility into a hot lab including a cyclotron particle accelerator for radiopharmaceutical production in cancer treatment research. A design consultant produced bridging documents for use in the Request for Proposal and a value-based selection process was conducted to select a design build team. This was considered a highly complex project, with multiple funding sources, several end user groups, and various regulatory agencies. Once a DB team was selected, researchers from ASU provided training and support for running the pre-contract planning process. The planned duration for the planning process was three weeks, during which time the DB

team would address owner concerns, coordinate with various owner groups, generate a milestone schedule, and plan the execution strategy.

As a result of the pre-contract planning model, the DB team identified significant unforeseen risks that had the potential to impact the project with millions of dollars in additional costs as well as considerable schedule delays. The DB team communicated these unforeseen risks to the owner and requested that the preplanning process be extended from 3 weeks to a full 4.5 weeks in order to properly mitigate such significant risks before commencing operations. This process enabled the DB team to address the unforeseen risks and optimize the facility prior to signing the contract. Specific risk solutions were integrated into an operational project plan, including a clearly defined scope, milestone schedule for the project's duration, agreed-to base contract alternates (as value added items), client action items and deliverable dates, workflow process charts, an operational work plan, financial billing process charts, and a risk management plan wherein all risks were identified and prioritized, with actionable solution plans determined and potential impacts communicated. All deliverables were completed and agreed to prior to contract signing.

The impact of these deliverables and the alignment they created through a process-oriented preplanning process was tremendous. Project team alignment was accomplished, with the owner adopting a supportive role by having their project manager function as the communication point for the external DB team and also managing the University's internal clients. The Best Value Preplanning Model resulted in significant savings by aligning the project team and identifying and addressing unforeseen risks. Had the team followed a more traditional process and jumped straight into contract, there would have been increased costs that would have driven other changes. Instead, the pre-contract planning methodology enabled the DB team to optimize the functionality of the building. Owner estimates stated that the pre-contract saved 14-18 months in schedule and $8-12 million in cost when compared against traditional processes that would have resulted in change orders during construction.

CONCLUSIONS

The need for more standardized and effective planning processes is present in the current construction industry. Proper preplanning not only enhances project performance in terms of hard dollars, schedule, and quality, yet many owners and contractors lack the expertise or the will to thoroughly perform this important task. The Best Value Preplanning Mode is a pre-contract, process-oriented planning methodology that has been applied in the construction industry and documented to significantly improve project performance. Encouraging case study results suggest that pre-contract planning between owners and contractors may be a viable consideration in the construction industry. More extensive testing and analysis is recommended in order to validate the approach.

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IMPLEMENTING HOLISTIC RIGHT OF WAY INFRASTRUCTURE MANAGEMENT: USING INFORMATION TO ELIMINATE BUREAUCRATIC BARRIERS

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ABSTRACT

Right of way infrastructure assets (water, sewer, and roads) are declining in performance and facing a deficit in planned maintenance, rehabilitation, and renewal spending that is necessary to ensure satisfactory performance levels. One method to help alleviate the planned spending deficit is to eliminate the traditional planning approach, which suffers from departments that operate in silos. This can be achieved through holistic planning methods that consider water, sewer, and road networks simultaneously when generating maintenance, rehabilitation, and renewal plans in order to generate economies of scale by synchronizing collocated projects from different infrastructure components. In order to achieve organizational change towards holistic right of way infrastructure management, municipal leaders need to utilize dominant information in order to spur a paradigm shift and overcome bureaucratic barriers.

Keywords: Infrastructure Planning, Organizational Change, Evolutionary Algorithm, Maintenance, Rehabilitation

INTRODUCTION

The traditional decision making paradigm associated with the planning of maintenance, rehabilitation, and renewal activities for right of way infrastructure assets (water, sewer, and roads) suffers from the silo effect. The complicated nature of the decision-making process has caused the departments that are responsible for specific infrastructure networks to evolve to a point where they operate in silos. Technical experts that manage these mini-silos have deep expertise and a narrow span of authority (Modemeyer, 2011). Therefore, when projects are conceived, it is almost always within the context of a

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particular line of business and disincentives discourage a broader scope: departments do not control other departments' budgets and collaboration can complicate project management and timelines (Antonoff et al. 2009). Figure 1 illustrates the current paradigm where road, sewer and water departments receive their the monies allocated for their infrastructure component's maintenance, rehabilitation, and renewal and proceed to develop their plans without consideration for other utilities.

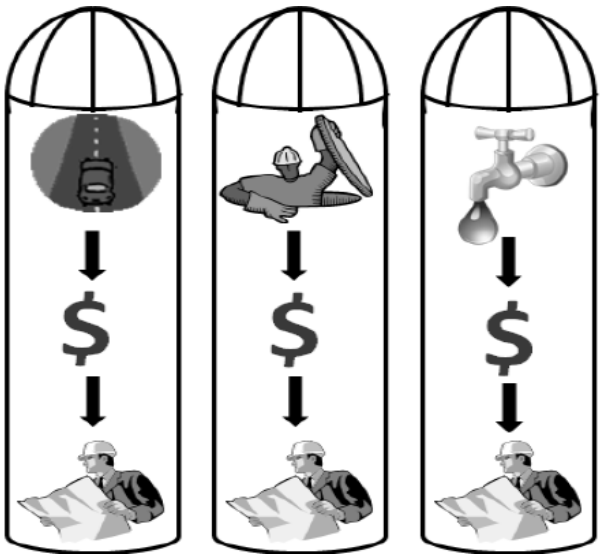

Figure 1. Graphical membership function of the three fuzzy sets

As was identified by Antonoff et al. (2009) the consequences associated with operating in the traditional paradigm is that transportation projects miss opportunities to provide access to utilities and utility projects move on their own timeline without coordination across utilities. Therefore, opportunities for city-wide benefits are not realized because departmental priorities supplant broader priorities (Antonoff et al. 2009). The consequences of missed opportunities for city-wide benefits are exacerbated when you take into account the fact that the Environmental Protection Agency (2008) identified that a significant portion of the nation's infrastructure has reached, or will soon reach, the end of its projected useful life. The American Society of Civil Egineers (2009) identified that the aging right of way infrastructure assets in the United States were facing a substantial shortfall in funding during the subsequent five year period. Road systems were identified as facing a $549.5 billion shortfall in planned spending that was deemed necessary to maintain satisfactory performance levels, while water and sewer systems were identified as facing a combined $108.6 billion shortfall. A paradigm shift that would eliminate the current silo paradigm and create a new paradigm where departments engage in holistic planning, which involves the simultaneous consideration of water, sewer, and roads during planning stages, would help to reduce the shortfall in planned spending.

The need to break out of the current paradigm and adopt an integrated holistic decision-making tool that considers geospatially interdependent infrastructure components has been widely recognized (Halfawy et al., 2002; Lalonde and Bergeron, 2003; Halfawy et

al. 2008; Nafi and Kleiner, 2010; Shahata and Zayed, 2010; Di Sivo and Ladiana, 2011). If a municipality were able to make a shift from the current operating paradigm and adopt a holistic planning model, significant savings can be achieved by synchronizing maintenance, rehabilitation, and renewal activities for collocated road, sewer, and water segments. Nafi and Kleiner (2010) examined three types of economies of scale due to infrastructure adjacency, namely: quantity discount, contiguity discount savings on mobilization costs, and synchronization of pipe replacement with known scheduled roadwork. Project cost savings ranged from a possible 10 percent savings through quantity and contiguity discounts, to 20 cost percent savings when road projects provide access to the utilities beneath.

This research presents a brief overview of the results obtained in the testing of a holistic methodology for planning maintenance, rehabilitation, and renewal of right of way infrastructure assets. Next the paper identifies how those results can be used to overcome bureaucratic boundaries in order to achieve a paradigm shift towards holistic planning. The results presented examined only economics; however, those results indicate that holistic planning has the potential to have a positive effect on all three pillars of sustainability: economics, social impacts, and environmental impacts.

HOLISTIC METHODOLOGY RIGHT OF WAY INFRASTRUCTURE PLANNING

Amongst engineers and researchers, there is a common view that proactive and preventive repair strategies are more effective than the traditional approach of reactive maintenance (Fenner, 2000). This has led to the development of many different methodologies for the planning of maintenance, rehabilitation, and renewal for individual component networks. Most of these methodologies involve the detailed data collection that requires the consumption of time and financial resources, while also being computationally intensive. Planning methodologies for the maintenance, rehabilitation, and renewal of individual road, sewer, and water networks have evolved to the point where most current models employ optimization techniques. Of those optimization techniques, evolutionary and genetic algorithms have moved to the forefront due to their ability to successfully solve or determine near optimal solutions for discontinuous, non-differentiable, non-convex, and multiple peak function optimization problems (Lee et al. 2009). Additionally, evolutionary methods are very effective at searching global solutions and providing multiple solutions (Yang, 2010).

Much research has been conducted into the optimization of planning for single component network maintenance, rehabilitation, and renewal. Examples of planning methodologies that make use of evolutionary or genetic algorithms for water network maintenance, rehabilitation, and renewal include Dandy and Engelhardt (2001), Cheung et al. (2003), Mailhot et al. (2003), Alvisi and Franchini (2006), Dandy and Engelhardt (2006), Giustolisi et al. (2006), Dridi et al. (2009), Haddad et al. (2008), Nafi et al. (2008), Alvisi and Franchini (2010), and Giustolisi and Berardi (2010). Methodologies making use of evolutionary methods for sewer maintenance, rehabilitation, and renewal include Halfawy et al. (2008), Lee et al. (2009), and Yang et al. (2010). Research efforts

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that applied evolutionary methods in an attempt to optimize planning for roadway maintenance, rehabilitation, and renewal include Fwa et al. (2000), Ferreira et al. (2002), Wu and Flintsch (2009), and Deshpande et al. (2010).

Literature related to the research conducted on singular network optimization revealed that the following three items must be taken into consideration in order to prioritize and optimize maintenance, rehabilitation, and renewal:

- Condition: the actual physical condition of in place segments belonging to the component network.

- Criticality: The importance of each segment within a component network, which includes consideration of a segment's capacity, the area served by a segment, and the segments position within a network (i.e. how many dependant segments).

- Cost/Benefit: The identified cost of any action and the impact that undertaking those costs will have on the network or community.

The authors developed an objective function that utilized the condition ratings and criticality ratings for each segment within a sample network in order to prioritize maintenance, rehabilitation, and renewal. The objective function was designed to be holistic in nature and consider all three right of way networks simultaneously. The savings percentages identified by Nafi and Kleiner (2010) were applied to collocated segments from different infrastructure components receiving rehabilitation or renewal in the same year. The objective function minimized the average yearly component score (CS) for each segment, where the component score was a sum segment scores (S) for each segment within a given component network. Segment scores for each individual segment were calculated by taking the criticality rating (CR) assigned to that segment and multiplying it by the square of the condition rating (C). Simplified 0-100 scales were used for both CR and C. For criticality rating, a score of zero would indicate and a segment with little importance to the overall conveyance scheme and a score of 100 would indicate a segment that is of the upmost importance. For condition rating, a score of zero would indicate a brand new asset that had yet to suffer any degradation and a score of 100 would indicate an asset that has reached the end of its useful design life and that is suffering in performance. This allowed for the system to be portable and easily applied to any network. Municipalities with already in place condition rating and criticality rating schemes could simply use a conversion rubric when entering condition and criticality scores into the decision making engine. The calculation of yearly component score can be seen in Equation 1. The formula for segment score is seen in Equation 2. Equation 3 shows the holistic objective function.

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(1)

(2)

(3)

The component scores in the objective function were minimized by identifying and prescribing predetermined maintenance, rehabilitation, and renewal actions to individual segments over a defined planning horizon. Each action that was prescribed had a defined cost and impact on the condition rating for the given segment. The costs that were

applied were based on historical costs from publicly funded projects in the State of Arizona. Using a five-year planning horizon, the authors applied the objective function to a right of way network in Tucson Arizona. The holistic objective function was tested for its ability to prescribe superior plans to the traditional paradigm where component networks are considered in isolation. The holistic objective function was tested across three different budgets representing different levels of available financing (Low, Medium, and High), and solved using the evolutionary algorithm within Frontline Systems, Inc. Premium Solver Platform. Twenty optimization runs were conducted for the holistic objective function and compared to the results of individual component optimization runs conducted for roads, sewer, and water that used the same methodology for calculating component score but were run independently of the other right of way components. Overall the holistic objective function succeeded in providing superior plans in terms of minimizing the component score of each component while also saving money. This was achieved despite searching a much larger search space plagued by a greater possibility of achieving an infeasible answer. Results showing the average percent better in terms of component score over the twenty runs for the holistic function and the money saved can be seen in Table 1.

Table 1. Holistic Model's Ability to Outperform the Individual Models

Criteria	Low Budget	Medium Budget	High Budget
Percent Better for the Holistic Mean Component Score from 20 Optimization Runs:	3.1%	6.8%	8.7%
Percent Better Best Component Score:	2.3%	10.2%	9.8%
Average Percent of Budget Saved via Holistic Method:	8.6%	10.4%	10.8%

USING HOLISTIC RESULTS TO OVERCOME BUREAUCRATIC BARRIERS

While achieving a paradigm shift towards holistic right of way infrastructure planning faces many challenges, there are two primary bureaucratic barriers that prevent holistic planning from becoming a reality. The first bureaucratic boundary is the general nature of municipalities that are operated within democratic governments. City council members, assemblymen, and various other elected representatives lobby for right of way maintenance, rehabilitation, and renewal dollars to be spent in the areas they represent. This allows them to provide their constituency with tangible evidence of their efforts to improve the infrastructure in the area they represent. This operational structure can lead

to inefficient spending of taxpayer dollars where certain areas receive more funding based on the ability of their representatives to solicit funds.

The second bureaucratic boundary that prevents a paradigm shift towards holistic planning for right of way infrastructure maintenance, rehabilitation, and renewal stems from departmental priorities and specialization. As was noted by Antonoff et al. (2009) opportunities for city-wide benefits are not realized because departmental priorities supplant broader priorities. The results of departmental priorities supplanting broader priorities is similar to the results generated when city officials direct spending to occur in the areas that they represent. In the case of departmental priorities supplanting broader priorities, department heads direct spending to occur in areas where the dollars will have the most visible impact; thus, giving the outward appearance of a job well done. The potential for neglect in less visible areas is prevalent under this system and as was noted previously the consequences associated with operating in the traditional paradigm is that transportation projects miss opportunities to provide access to utilities and utility projects move on their own timeline without coordination across utilities (Antonoff et al. 2009).

Overcoming these two barriers and a achieving a paradigm shift will require the use of dominant information. As noted by Kashiwagi et al. (2009) and Hamel (2007), without dominant performance information perceptions and decision-making by industry experts will maintain the status quo. In the case of right of way infrastructure management there are several pieces of dominant information that need to be used by managers in order to generate the support required to achieve the paradigm shift towards holistic right of way infrastructure management. Such pieces of dominant information include:

- The status quo method of managing right of way infrastructure networks from within silos has lead to a $658.1 billion shortfall in planned spending that is considered necessary to operate the nations road, sewer, and water networks at satisfactory levels.

- When applied to a right of way network in Tuscon, Arizona, the holistic maintenance, rehabilitation, and renewal planning model that is presented in this research generated a minimum average budget savings of 8.6 percent over a five year planning horizon by synchronizing collocated projects from different infrastructure components in order to achieve economies of scale.

o When applied to the $658.1 billion shortfall that 8.6 percent savings would eliminate $56.6 billion dollars of the deficit.

- The holistic approach described above can be applied to any network without the need for municipalities to abandon their current condition and criticality rating programs. The methodology was designed to assist in decision making, not to redefine condition rating procedures.

Dominant Information to Overcome Boundary One

The dominant information generated in the form of the superior maintenance, rehabilitation, and renewal plans that are generated by the holistic methodology described in this research needs to be used by municipal managers to overcome the inefficient

practice of city representatives demanding that infrastructure funds be spent in their area. The fact that the maintenance, rehabilitation, and renewal plans that are generated by the holistic methodology are generated using modern evolutionary algorithms that consider millions of generations of possible answers before settling on an optimal or near optimal plan, can be used to assuage any city representative demanding that money be spent in the area that they represent. The data generated by the holistic methodology can be used to show the city representatives the holistic plan creates a plan that is the best for the city as a whole and should not be ignored in order to cater to the emotional appeal of an individual representing a constituency. It also serves to hold them accountable for their decisions should they choose to ignore the data generated by the holistic methodology.

Additionally, the savings that are generated by the holistic methodology can be shown to elected representatives in order to show the amount of funds that are being saved and reinvested for use on additional projects. With the project synchronizations that are identified by the holistic methodology, those savings would not be realized and the additional projects undertaken using those savings would not be possible.

Dominant Information to Overcome Boundary Two

Municipal managers can also utilize the dominant information identified above and that is generated by the holistic methodology in order to overcome the boundary that is put into place by the current paradigm where departments operate in silos. The holistic plans outperform plans generated by individual planning methodologies in terms of cost and the number of project that are able to be undertaken. When presented with this information, departmental managers will be hard pressed to continue to operate in their silos.

One area of difficulty that departmental managers that are responsible for a single infrastructure component might have is that the holistic methodology requires some give and take by networks that are being considered in the methodology. An example of this might be the water department having to push back a water project a year or two in order for a collocated road project to have the necessary funding to be undertaken. While the water department might have the funds ready to undertake their project, by waiting for the corresponding road project, a 20 percent saving can be achieved through combined overhead and the road project providing access to the subsurface waterline. Departments will have to be able to shift their thinking towards long term city objectives rather than short term departmental goals.

Departmental managers that fear and increase in workload or the stretching of resources in order to utilize the holistic method should also be informed that it requires no changes to their current data gathering, condition rating, and criticality rating procedures. After importing the data associated with a municipalities GIS, the decision making engine can run in the background with minimal human interfacing. During the times when projects

need to be identified the output from the holistic methodology would be consulted and the projects that it identifies can be put into motion.

CONCLUSIONS

A holistic methodology was created for the planning of right of way infrastructure maintenance, rehabilitation, and renewal of right of way infrastructure assets. The methodology considers all three networks simultaneously in order to synchronize projects for collocated segments from different infrastructure components in order to generate savings in the form of shared overhead and road projects providing open space to subsurface utilities. The methodology was designed to be easily implementable without requiring municipalities to dedicate resources to adapting their condition and criticality schemes that are already in place. The results of the application of the methodology to a right of way infrastructure network in Tucson, Arizona showed a minimum savings of 8.6 percent of the maintenance, rehabilitation, and renewal budgets for water, sewer, and roads during the five year planning horizon. With these savings additional projects were able to be undertaken and the overall condition of the three infrastructure components were improved when compared to the traditional paradigm where departments operate in silos. The information generated by the holistic methodology should be used by municipal managers to ensure cooperative planning across departments and to break departmental employees out of their silos. Additionally, the information associated with plans generated using the holistic methodology should be used to by municipal managers to overcome the inefficient practice of city representatives demanding that infrastructure funds be spent in their area. The fact that the maintenance, rehabilitation, and renewal plans that are generated by the holistic methodology are generated using modern evolutionary algorithms that consider millions of generations of possible answers before settling on an optimal or near optimal plan, can be used to assuage any city representative demanding that money be spent in the area that they represent.

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MINIMIZING PROTESTS THROUGH A TRANSPARENT SELECTION PROCESS

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ABSTRACT

Government organizations have seen the amount of protests on public procurements increase. Protests are a problem because they require additional resources and time to procure public services. The Industry Structure (IS) theory identifies that the problem is due to buyer decision making and control. The State of Oklahoma in partnership with Arizona State University in an effort to resolve their protest issues, tested a procurement process that forces the decision making and control onto the supplier. The results of the test cases are shown in this paper. The results show, as clients minimize decision making and force suppliers to be responsible for showing their expertise, protests are minimized, cost decreases, and performance increases.

Keywords: best value, buyer, PIPS, procurement, protests, supplier

INTRODUCTION

Government organizations for the last decade have had to deal with suppliers protesting their purchasing processes and awards. This is an issue that government organizations have seen continually grow. The State of Washington identified that they receive around twenty protests a year, and they have seen that grow from 2003 (Zeigler, 2006). The University of Maryland (2009) did a bid-protest study on the Department of Defense (DoD), identifying that the bid-protests have increased 40% from 2001-2008 (Gansler, Lucyshyn, and Arendt, 2009). The Government Accountability Office (GAO) released their fiscal year 2011 statistics on protests and found the following (GAO, 2012):

1. GAO received 2,353 protests in 2011. This increases by 2% from 2010 and over 40% since 2007.
2. They sustained 67 protests.
3. Hearings were conducted for 8% of the cases.

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The GAO stats also show that in 42% of the cases, the protestor received some form of relief from the government. One of the major problems with protests is that they can be time consuming and costly, taking resources away from needed improvements and services. Some of the main reasons for protests were are as follows (GAO, 2012):

1. Failure to follow procurement process correctly.
2. Improper evaluation technique.
3. Incorrectly evaluating a supplier's proposal.

State of Oklahoma Protest Problems

In 2008, the State of Oklahoma purchasing department approached, the Performance Based Studies Research Group (PBSRG), based out of Arizona State University, with the problem of their purchasing process and awards being protested by suppliers (OCDPS, 2009). The State felt that due to their procurement process, they were not able to justify their selection decisions, which allowed suppliers to continually protest their awards. This caused the following problems for the State:

1. The time to procure services was lengthened.
2. The cost for suppliers to bid on their projects would increase.
3. The cost of the State to procure services increased.
4. Prevented the State, in some instances, from obtaining the highest performing and lowest costing services.

Some of the problems they were experiencing with their current procurement process were:

1. Justifying the ratings given to supplier bid proposals.
2. Justifying pricing evaluation.
3. The complexity of the process caused difficulty for both the purchasing agent and the suppliers participating on a solicitation.
4. Proving selected suppliers meet mandatory requirements.
5. Justifying disqualification of suppliers due to not meeting requirements.

The State was in search for a procurement process that not only prevented protests from occurring, but also was still able to identify high performing suppliers from both price and other criteria.

Industry Structure Model

To identify a solution for the State of Oklahoma purchasing department, PBSRG used the Industry Structure model developed by Professor Kashiwagi (1991). The Industry Structure (IS) model was originally developed for the construction industry, but has now been applied to all services industries (Kashiwagi, 2012). Figure 1 is the industry structure (IS) model. The Industry Structure assumes the following:

1. The client is not the expert and has less experience in delivering services than suppliers.

2. The supplier is the expert on delivering services.
3. When the supplier controls and manages a project, the efficiency on the project improves due to the supplier's expertise.

The IS concept also identifies the price-based and the value-based environments. The major difference between the two quadrants is that in the price-based quadrant, the buyer or client is the one controlling and managing the project. Characteristics that accompany the client controlling and managing the project in the purchasing of a service include:

1. Client identifying what the requirements of the project are.
2. Client being responsible to identify the difference between suppliers in the evaluation process.
3. Client being responsible to validate that the suppliers have met the requirements on the project.
4. Client is responsible to ensure project performance.

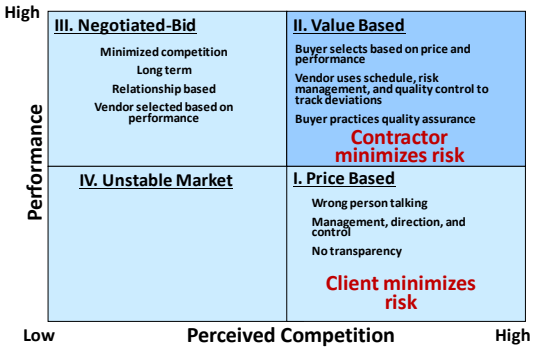

Figure 1: industry Structure (Kashiwagi, 2012)

However, since the client is not the expert, they are not capable of performing the actions of managing and controlling a project. Therefore, the performance and efficiency on a project decreases. When the client tries to take control of the project the following occurs:

1. More decisions are made.
2. The situation is more complex.
3. Risk and errors increase.
4. Efficiency decreases.

The IS identifies that in the value-based quadrant, performance increases due to allowing the expert to be in control of a project. The expert supplier is, therefore, required to do the following when participating in the procurement of a service:

1. Must compete to identify themselves as the best value.

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2. Identify what the requirements of the service should be.
3. Show validation that they meet the requirements of the service.
4. Identify what differentiates themselves from other suppliers.

When a supplier is in control of a service the following occurs:

1. The supplier is responsible for decisions.
2. The situation becomes clear and transparent.
3. Risk and errors decrease.
4. Efficiency increases.
5. The process becomes simple and easy to understand.

The IS identifies that currently protests are a problem for purchasers, because the wrong person is in control of the service. The authors propose that as buyers transfer control and accountability to expert suppliers, protests will decrease and become easier to handle due to the following:

1. The selection process will be less complex and easier to perform.
2. Risk and Errors in the selection process will be minimized.
3. Transparency of the process and decisions will be easier to justify.
4. Evaluations will be more objective and less subjective.

PIPS Process

The only procurement system the researcher could find that allowed the buyer to let the expert suppliers take control of the service was the Performance Information Procurement System (PIPS). The PIPS has three phases (Figure 1). The phases are selection, clarification of proposal, and the award of contract and risk mitigation. The selection phase has multiple competing offers. The clarification phase handles one supplier at a time, starting with the vendor identified as the highest performing. Suppliers are assumed to be experts and are at risk until they are identified and their offer is accepted by the buyer. Suppliers can be eliminated before the selection starts due to being non-responsive to the process requirements or at the short listing where due to multiple suppliers proposing, interviewing all the suppliers may not be logical, especially if some are non-competitive after the first few submittals. Suppliers can also be eliminated if they are not in the competitive range (too high a price or too low a price), or if a supplier's submittal contains inaccurate material. If buyer has to make a decision, the supplier is probably not the best value supplier.

Figure 2: Performance Information Procurement System (PIPS) Phases (Kashiwagi, 2012; Kashiwagi, et. al., 2009)

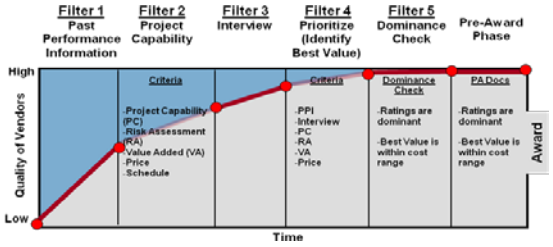

Figure 3: Selection Phase Filters (Kashiwagi, 2012)

The selection phase criteria are (weights in parenthesis showing potential importance):

1. Past performance information that is required on the supplier and the individual (10).
2. Project capability (20).
3. Risk assessment (15).
4. Value added (10).
5. Price (20).
6. Interview (25).

The price is already controlled by the budget and the competition. If the best value is over 5% over the next best value, it is deleted unless there is dominant information to show otherwise. The percentage is predetermined by the buyer. If the best value is lower than 10% below the average price, the supplier can be eliminated unless the supplier has submitted dominant information in the proposal. Dominant information is when the information is simple, easy to understand, and motivates the buyer to act without extra justification. The Selection Phase filters (Figure 2) work in unison to mitigate the chance of a non-performer getting the award or a protest occurring. The key components of the best value approach are:

1. Project capability, risk assessment, and value added submittals are short (2 pages maximum) and contain claims and verifiable measurements to support the claims.
2. The rating system is "10", "5", and "1." If a decision has to be made, the rating is a "5." If the claim is high performance, and the verifiable performance metrics are submitted, the rating is a "10."
3. The supplier's key personnel must go through an interview and identify what they are going to do before they do it, how it is different and how they will

mitigate risk that they do not control. The supplier's project manager's answers will be concise, short and clear.

4. The environment is transparent. Decisions will not be made. Time will not be spent to make decisions. If dominant information is not provided that identifies a vendor as a performer, the selection committee rating will be a "5" signifying the selection committee does not know if they are a performer. The predominant rating given is a "5". Instead of identifying a vendor as a non-performer, the system identifies the dominant performer who is supported by dominant information. [Simple, easy to observe information that leads to consensus and needs no further justification.) After the selection phase, the clarification phase will ensure the supplier can perform.

CLARIFICATION PHASE

The highest prioritized best value that has made it through the selection phase and dominance check will enter the clarification phase. The supplier will clarify their proposal. The rationale is that only the supplier who is going to do the job should be required to do detail planning. The supplier will clarify their proposal with more details. The clarification will include (Kashiwagi, 2012):

1. What is in and what is out of the scope.
2. A detailed schedule that will include activities where there is not enough information or elements that are outside the control of the supplier.
3. How the risk will be mitigated.
4. How the supplier's performance of risk mitigation will be tracked.
5. A weekly risk report that will include a milestone schedule, documentation of all project deviations, the source of the deviations, and the solutions, a tracking of the cost deviations and a risk management plan to mitigate risk.
6. Answer any technical questions the buyer's subject matter experts (SME) may have.

The supplier will then put together the above information, the client's requirements, the client's legal contract requirements and any other documentation, and submit it as the supplier's offer. Once the buyer accepts the offer, the supplier must perform according to their contract, reporting weekly to the buyer. The supplier is responsible for quality control and risk management, and the client is responsible for quality assurance (ensuring that the supplier has their risk management program and the project requirements are being met.) The Best Value PIPS Environment should place the client in a very non-confrontational position in selection processes due to:

1. Minimized decision making.
2. Suppliers propose and prove that they are the best value based on dominance.
3. Finding best value for the lowest cost.
4. Use of dominance required for greater value.
5. Transparency.
6. Documentation of performance information.
7. Protesters are left out on the limb. They must prove poor decision making or bias.

Hypothesis
Following the Industry Structure theory, it was proposed that a process which gives control to the right party, minimizes buyer decision making, and uses transparency will minimize protests and allow the public to defend them better.

Methodology
To test the hypothesis it was proposed that the State of Oklahoma test the PIPS on three projects that have had a history with protests, then to document the results to see if the process helps minimize the State's problems with protests.

State of Oklahoma Protest Projects
The State of Oklahoma identified the following projects to run with the PIPS process (Kashiwagi, 2011):

1. Light Bulb and Fixture Contract
2. Emergency Hazardous Waste Removal
3. Juvenile Services and Facility

Light Bulb and Fixture Contract
The procurement of the State of Oklahoma Light Bulb and Fixture contract had a long history of protests. This was the first procurement they decided to test the PIPS process on. The scope of work for this contract was supplying all light bulbs and lighting fixtures for the State. It was estimated at $3M over the course of three years. After the selection process was performed, one of the suppliers was selected for the service. The top 3 suppliers' final scoring are shown in Figure 4.

Top Three Suppliers

No	Summary Criteria	Unit	Vendor 1	Vendor 2	Vendor 3
1	Cost	#	$117,440.47	$104,017.99	$108,295.70
2	RAVA Plan	(1-10)	6.10	8.2	6.3
3	PPI Survey	(1-10)	9.98	9.896	9.785
4	PPI #/Clients	#	10.00	10	8
5	Interview	(1-10)	7.5	5.25	8

Normalization

No	Summary Criteria	Unit	Vendor 1	Vendor 2	Vendor 3
1	Cost	#	0.89	1.00	0.96
2	RAVA Plan	(1-10)	0.69	0.92	0.71
3	PPI Survey	(1-10)	1.00	0.99	0.98
4	PPI #/Clients	#	1.00	1.00	0.80
5	Interview	(1-10)	0.94	0.66	1.00

Final Scoring

No	Summary Criteria	Unit	Vendor 1	Vendor 2	Vendor 3
1	Cost	#	39.86	45.00	43.22
2	RAVA Plan	(1-10)	10.28	13.82	10.62
3	PPI Survey	(1-10)	10.00	9.92	9.80
4	PPI #/Clients	#	5.00	5.00	4.00
5	Interview	(1-10)	23.4375	16.40625	25
			88.58	90.14	92.65

Awarded Supplier

Figure 4: Top Three Suppliers

Selection justification for Supplier 3 was as follows:

- Supplier 2 did not complete pricing sheet
- Supplier 3 was backed by 2 out of 3 of the major lighting manufacturers.

- Supplier 3 offered to provide a State training program for all state end users.
- Supplier 3 Offered audits of facilities for analysis to improve energy efficiencies and lighting products.
- Supplier 3 had the highest interview rating.
- Supplier 3 would track and document all transactions and provide performance measurements throughout the length of the contract.

After the selection was announced two suppliers protested. Supplier 4 had a history of protesting this contract, and had always been successful with acquiring a piece of the service. They were kicked out of the procurement process due to placing their name on the submittal. Supplier 4 tried to protest for the reason identified in Figure 4.

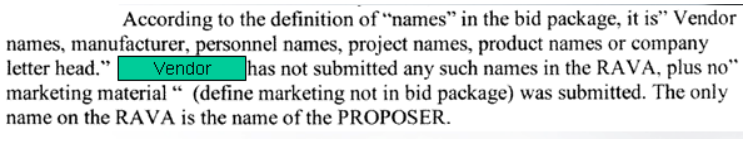
According to the definition of "names" in the bid package, it is" Vendor names, manufacturer, personnel names, project names, product names or company letter head." Vendor has not submitted any such names in the RAVA, plus no" marketing material " (define marketing not in bid package) was submitted. The only name on the RAVA is the name of the PROPOSER.

Figure 5: Supplier 4 Protest Reason

Their protest was denied due to the following reasons:

- 4 out of 6 suppliers understood the rules and had no complaints.
- 1 supplier apologized for putting their name on the submittal.
- All suppliers were allowed to ask questions of clarification, Supplier 4 did not ask a question on the RAVA plan names.
- "Proposer" and "Vendor" used interchangeably throughout RFP.

After the explanation Supplier 4 decided not to pursue their protest. It was the first time Supplier 4 was not able to successfully protest the light bulb award. Supplier 2 also threatened to protest the bid. Their claims were as follows: Penalized due to not having a manufacturer representative at interviews and a better interview would have won them the contract. The protest was denied for the following reasons: suppliers all agreed that manufacturer representative should be optional at pre-bid meeting, addendum sent out from the state on the issue, and interview dates were posted for over 3 weeks. After the explanation Supplier 2 also decided not to pursue the protest. The selected expert supplier ended up giving the State a very high level of service. During the first quarter of the contract the supplier, through their documentation of services provided, found that they could offer the State greater savings on certain items due to the amount of the item the State was purchasing. The supplier has given the State over $133K worth of discounts, which has saved the State over 60% on their purchases, from the supplier's original pricing.

This project showed the State of Oklahoma that protests can be minimized by a process that: tells the suppliers upfront what is required, allows the suppliers to have

input in the process, and gives the suppliers a simple explanation to any questions they have concerning the fairness of the process.

Emergency Hazardous Material Removal

The State was looking for multiple suppliers to provide emergency response for clean-up and removal of hazardous waste. Historically there were two main suppliers for this service and if either supplier did not get awarded the contract they would protest the award. After going through the selection process, Supplier A and F were selected for the award, neither one were the main suppliers that had received the awards for the previous solicitations. One of the larger incumbent suppliers tried to protest the process due to the following reasons: having the lowest cost, lack of credibility of other firms, and faulty evaluation of bids. The result was as follows:

1. Supplier D protest to purchasing director denied.
2. Supplier D appeals to administrative law judge.
3. Supplier D did not show up for the court hearing.
4. Protest Denied.

Due to the simplicity of the process and the thorough documentation kept by the process, the contracting officer was able to quickly prepare the State's defence with minimal legal aid. Both the lawyer and the contracting officer were disappointed that the supplier did not show up, due the strength of their case. The performance of the selected suppliers turned out to be very high performing. Although the award suppliers were smaller than the other companies, they turned out to be just as reliable and capable of delivering high quality services as the larger suppliers.

Having a simple transparent process was able to not only to defend against a protest, but also helped to provide a system that allowed all companies to have a fair opportunity of being awarded State contracts.

Juvenile Services and Construction

The last project that was selected by the State of Oklahoma was services for running a Juvenile Detention Center and the building of a new Juvenile Facility. This project was at risk for many protests due to the following (PBSRG, 2012):

1. Many political entities would be involved in the process.
2. Both private and local governments would be involved in trying to bid for the project.
3. The selection committee involved many individuals that had political connections.
4. The State did not know a way to minimize subjectivity in the evaluation of the suppliers.

The PIPS process was able to minimize many of their concerns by the following:

1. All supplier evaluations were performed "blind"; the selection committee did not know who submitted what proposal.
2. The interview ratings followed the PIPS rating scheme. Meaning that all suppliers received a rating of "5" (which meant the committee member did not know how "good" or "bad" the supplier was), unless they provided dominant information justifying a higher rating. This was enforced by the purchasing officer.
3. The entire process was documented and simple and easy to confirm. .
4. The State identified their need but not how to meet the need. They asked the suppliers to identify and propose their solution to the identified need of the State.
5. The State did not make any decisions. If the information was not "dominant" the selection was made based on the best value for the lowest price.

After the State selected a supplier to provide the service and construction, they received only 1 protest. That protest was then followed by an accusation that a lobbyist of the identified best value was having an affair with a State Senator, who had colluded to help the selected supplier get the contract. The protest process was then escalated to a review by the State Senate and then eventually by the Attorney General. The State was able to quickly respond with the documentation and information on the process. After reviewing the submitted information, the Attorney General sent out an official statement saying (Kashiwagi, 2012):

"*In conclusion, there does not appear to be any evidence that DCS (State Purchasing) procedures were compromised or that any undue influence was exercised during the RFP process at issue. Based on my understanding of the PIPS process as outlined above, it would be very difficult for someone to manipulate the blind evaluation procedures that are in place. In this instance, the winning RFP was judged to be superior by a fairly wide margin. This judgment was shared across the board by all evaluators. The existence of an affair between a Senator and an interested lobbyist is irrelevant due to the controls present in the PIPS system. There was no evidence that the process was compromised or undue influence was exerted to justify further investigation of this matter as a potential criminal violation."*

After 2 months the protest was denied. Unfortunately, due to more political activities, the project was not funded. However, the process clearly showed how the procurement office could easily navigate through a very “protestable” environment with the least amount of effort.

CONCLUSION

A process was created that minimized protests by changing the control of a service to the right party, minimizing decision making, and creating transparency, minimizing protests and helping the State of Oklahoma government purchasing departments become better equipped to defend against protests. The State of Oklahoma ran three projects testing the protest minimizing PIPS, a process that allows the buyer to switch accountability and control to the “expert” suppliers. The results of the tests found the following:

1. The process minimized protests from occurring.
2. The process helped the State to defend against protests that do occur.
3. The process helped resolve protests easily and quickly.
4. The process helped the State to award and defend suppliers that could deliver the best value to the State.

By transferring control to the right party, it not only decreases the effort on government purchasing, but allows for a more efficient and value driven process to occur.

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PROCUREMENT MANAGEMENT: ANALYZING KEY RISK MANAGEMENT FACTORS

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ABSTRACT

Today, uncertainty represents a threat to any business and/or project; however, it can be handled with risk management to reduce its effects. Many industries have taken and driven an approach to risk management in their companies. Worldwide, the mining industry has had a sustained increase in investment, operational expenses and in outsourcing contracts, and has made procurement and contract management, an opportunity to obtain savings and developing competitive advantages, particularly when procuring construction services. This work presents the results of a research effort that has established key risk management factors in the procurement and contract management process, through a review of existing risk management maturity models, employee opinion, and a literature review. It describes characteristics of the identified factors, along with a description of its segmented features on a scale of 5 levels. It was concluded that the most leveraging factors for proper risk management in procurement and contract management are: organizational culture, implementation of risk management and process structure. The ultimate goal of this work is to present the key risk management factors to highlight them and raise awareness about the importance of managing risks, so that benefits can be received by the company, its projects, and its stakeholders.

Keywords: awareness, key factors, procurement and contract management, risk management.

INTRODUCTION

We are currently facing an increasingly more uncertain world, which represents a clear threat for businesses but also a chance to take advantage in generating even new opportunities (Hillson, 2011). The actual situation in the mining industry shows a sustained increase in operational expenses and the procurement of outsourced services (Cochilco, 2009; Consejo Minero, 2010). Handling the uncertainty, an effective procurement and contract management (PCM) become a key factor to obtain savings and to become developing competitive advantages (PriceWaterHouse Coopers and Memba, 2003). However, a systematic vision of Risk Management (RM) in PCM has

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not been established. Given this scenario, organizations wishing to implement a formal approach to RM or improve existing approach, need a framework to contrast their current practices (Hillson, 1997).

THEORETICAL BACKGROUND

Clearly, there is uncertainty in everyday life, organizations and projects (Olsson, 2007), representing a clear threat to the business, but also in itself is a significant opportunity that must be taken to improve (Hillson, 2011). Its definition has been taken from different points of view, but Hillson's (2004) connects it to a risk as follows: "The risk is the uncertainty measured, and uncertainty is a risk that cannot be measured."

Risk is a multifaceted concept (Wang et al, 2004), which is defined as the probability of a damaging event occurring within a project, affecting its objectives (Yu, 2002; Baloi and Price, 2003) however, it not always associated with negative results. Risk may also represent opportunities, but the fact is that most of the risks usually have negative results that have led individuals to only consider the negative side (Baloi and Price, 2003, Hillson 2011).

Risk management today is an integral part of project management (Olsson, 2007), and was originated from the U.S. in the 1930s, associated to insure the businesses at an early stage (Zheng et al, 2009). This is a key process and most project managers know that risk management is essential for good project management (Baloi and Price, 2003; Perera and Holsomback, 2005).
Risk management is defined as the process to identify, access risk and to apply methods to reduce it to an acceptable extent (Tohidi, 2011). Overall, RM process includes the following main steps (1) Risk planning, (2) Risk identification, (3) Risk assessment (qualitative and quantitative), (4) Risk analysis, (5) Risk response, (6) Risk monitoring, and (7) Recording of the RM process (ISO 31.000, 2009; Baloi and Price, 2003; and others).

On the other hand, from the point of view of the research procurement and contract management that has been analyzed due to its relevance to the commercial sector as an essential part of the supply chain (Pollice and Fleury, 2010). Although in the contracting corporate world it is not usually a major activity of an organization, it is a distinctive support function (Plomp and Batenburg, 2009). Organizations with established processes and mature PCM are able to generate millions of dollars in additional savings and have a clear competitive advantage over their competitors (Rendon, 2007).

The maturity models can provide a framework, which serves to carry out a comparative assessment (Demir and Kocabas 2010), lead the organization strategically, and link it to its continuous improvement (Brookes and Clark, 2009). While there are maturity models for RM (Jia et al., 2011), they are not fully described and there is not a complete developed model associated with the process of PCM.

RESEARCH PROBLEM

This research is intended to identify and describe the key factors for assessing RM in PCM in mining companies. These factors will be set through a literature review and a compilation of background information. This is provided by employees associated with the PCM process within a company belonging to the industry. Thus, it aims: (1) to raise awareness regarding these factors in order to develop the RM in the PCM, (2)

to find leverage factors for this process, and (3) to establish the basis for the development of an evaluation system and performance monitoring of RM in PCM (based upon maturity models). Given the above information and the context within which this process unfolds, a research question has been formulated as follows: What are the key factors and their importance for evaluating RM in PCM?
Then, the objective being pursued is to structure and describe the relevant factors for evaluating RM in PCM, providing an appropriate measurement range to develop a maturity model in the future.
This research, being based on insights and specific characteristics of the mining industry as well as important clients of construction companies and can also be a good reference for companies working in other areas.

RESEARCH METHODOLOGY

The methodology to carry out the research has been based on: (1) maturity models of RM that have been reported in the source of references, (2) papers and consulting results associated with both, the RM process and the PCM, and (3) results from information gathered within a mining company to put into context the factors according to the Chilean reality. In order to complement this information, an expert in RM in contracts has collaborated to the research with the purpose of having an expert view and validating the found factors. Already with the factors and their identified and described dimensions, a scale of general measuring has been structured, providing the basis for developing a monitoring and evaluation system based on maturity models.
After the key RM factors were identified, their main characteristics and dimensions have been defined. With the purpose of: (1) knowing the opinion of those involved in the process of PCM and (2) find out about the degree to which the key RM factors reflect the reality of the process and which are the leverage factors of RM in PCM, a questionnaire has been applied to mining companies' personnel. Figure 1 outlines the research methodology just described and it links each stage with the main results.

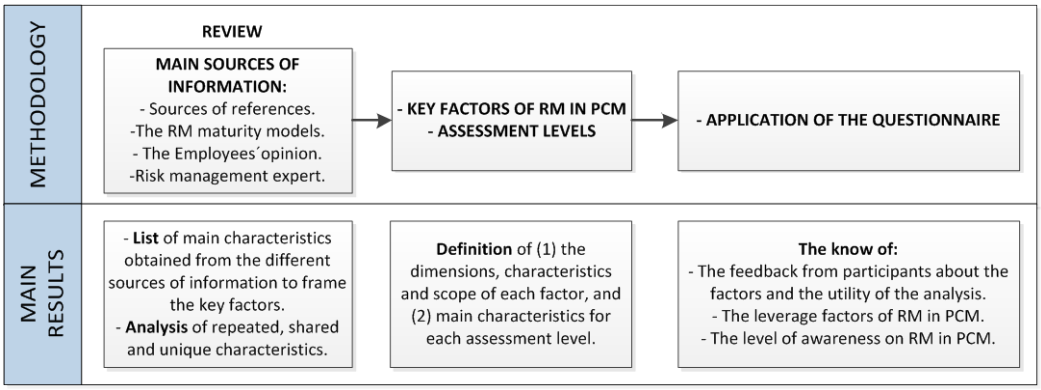

Figure 1. Summary of the research methodology.

MAIN RESULTS

Key factors:

The key factors of RM in PCM have been structured through a comprehensive analysis of four main sources. For each of the four main sources were classified the different key factors and their dimensions. Later another analysis was carried out for identifying the characteristics that were repeated, the ones that complemented each other, and the ones that were absolutely new. Finally, both analyses were classified

according to common classifications in order to obtain the main factors. This process was developed as already described in Figure 1.
The scope and characteristics of each factor are defined by each one's dimensions, as described in Table 1.

Table 1. Dimensions and characteristics of each key RM factor, designed by the authors.

Factors	Dimension	Characteristics
Organizational culture	Awareness of risk management	- Employees and directors of the company are aware of RM and the risks involved in PCM.
	Support from upper management	- Upper management encourages and requires the application of PM in the PCM, strengthening a proactive RM
	Increase of update regarding risk management	- Communicate and disseminate news associated to impacts caused by the occurrence of any risk in the hierarchical structure of the organization.
	Recognition of benefits and importance of RM	- Valuation of benefits related to the implementation of RM and the importance of the implementation and results of RM in PCM.
	Willingness to make changes	- Capable leaders in order to encourage changes in the company. - Development of an optimistic view of changes. - Organizational openness in implementing organizational changes.
	The ability to collaborate and communicate	- Communication, collaboration and synergy created within and between sectors such as interaction between sectors from different areas within the company.
Process structure	Formality of the process	- Existence of a formal process of RM in PCM. - Degree alignment of such processes to the type project and integration into the company.
	Documentation of the process and information availability	- Documentation of RM in PCM. - Information of RM in PCM stored and available to support decision making and process improvement.
	Motivation for the implementation	- Reason why RM has been implemented in PCM (internal motivation or imposed externally).
	Training and skills development	- Level of competencies and skills of personnel involved in RM in the PCM. - Knowledge frequently updated and refined.
	Expertise (expert knowledge)	- Participation and involvement of experts in RM in PCM process.
	Involvement of key stakeholders	- Level at which key stakeholders participate and get involved into the process of RM in PCM.
Development and experience in risk management	Performance evaluation of risk management	- Assessment of RM in order to monitor, learn lessons from the process and seek continuous improvement.
	Employees experience	- Opportunity for experts and others involved in RM to implement and carry out the PCM process. - Previous experiences of those involved in RM.
	Distribution and knowledge development	- How the RM in PCM has collected, stored, used and shared the knowledge within the organization. - Use of the knowledge to continuously improve / a support for decision-making.
Implementation of RM process	Implementation of risk management	- Continuous and systematic application of RM in PCM. - Number of projects implementing the RM in PCM.
	Resource allocation	- Availability and resource allocation for RM in PCM.
	Responsibilities	- Definition, allocation and acceptance for the responsibilities of involved in RM process in the PCM.
	Available technologies	- Availability, application and integration of technologies for the development of RM in PCM.
	Risk identification	- Comprehensive risk identification, using the organization's support, resources and available information.
	Risk analysis	- Qualitative and quantitative analyses of risks by using appropriate tools and techniques.
	Response to risks	- Selection of response strategies to follow according to the

Factors	Dimension	Characteristics
		previous experiences and points of view of the stakeholders.
	Monitoring	- Use of a monitoring and controlling system for risks. - Evaluation and feedback at the end of each project.

The table 1 shows the basis of present research and includes all the efforts of the review, analysis and structure of the collected information.

Analysis of the review

In the study of the different models certain similarities or shared approaches were identified, as well as complements and unique contributions. The most important aspects of this analysis are presented in Table 2.

Table 2. Main factors identified as "unique", "shared" and "complementary".

Unique	Level of training in basic skills associated with risk management of employees.
	Implementation and periodic training of basic competencies associated to risk management.
	Level in which is shared knowledge and skills associated to risk management.
	Measuring and comparing the performance of risk management.
	Recognizing the benefits/importance of risk management.
	Resistance to change/technology.
	Degree of involvement of stakeholders with the mission and objectives of the project.
	Collaboration/communication between teams.
	Level of availability of technology for the process.
Shared	Carrying out stages of risk management.
	Allocation of resources for risk management.
	Allocation, acceptance and compliance of responsibilities in risk management.
	Customer participation in risk management process.
	Degree to which are known and climbed to higher levels the "bad news" associated with risks.
	Collection, storage and use of available information.
	Support and priority of upper management.
	Carrying out proactive risk management.
	Channels for explicit communication regarding risks.
	Inclusion of risk management as integral part of project management.
	Degree of implementation of the process and risk management practices.
	Risk awareness.
Comple-mentary	Development of relationship with the external network (Sponsors, government, suppliers, etc.).
	Encourage and enhance relations within and outside the organization.
	Formality of the management system, especially risk management.
	Using the information of RM in decision-making.

This analysis has been essential to know the state of the art on the factors considered in the different sources of information and it has also shown a first view of the leverage factors for RM.

Assessment levels

Along the key factors, it has developed a general scale of evaluation based on the review and analysis of the source of references. Using these key factors the company can identify its current performance depending on the characteristics and conditions that it has presented in the assessment. Figure 2 describes these levels.

	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
Organizational culture	Null culture and organizational awareness of risk and RM in the PCM	Basic level in awareness of benefits of RM in the PCM	Support from upper management in key projects	Benefits under-stood at all levels of the organization	Proactive view of RM, search of continuous improvement
Process structure	RM process in the PCM, not formalized	Structure and organizational support emerging	There is a formal system of RM in the PCM	Activities of RM consider key stakeholders	Incorporation of RM in the PCM in the management of the company
Development and experience in RM	There is not any experience in RM in the PCM	The experience depends on the people involved	It is possible to face most known and predictable risks	Experts in the company. Lessons learned are documented	It is learned from experience. Process knowledge is managed
Implementation of RM process	RM process in the PCM is not carried out	Partial development of some stages within the RM process in PCM.	Implementation of an overall process of RM in the PCM	Implementation of a systematic process of RM. Is adapted on key projects.	RM policies and procedures. These characteristics are tailored to the project

Figure 2. General scale of main characteristics of each level, designed by the authors.

The key factors and the general scale of assessment are the basis for building a monitoring and assessing system of RM in the PCM. Thus, forming framework to compare the current practices of the company studied.

Employee opinion

Finally, a questionnaire has been applied to eleven people involved in the PCM process in a mining company. All the factors were presented with their dimensions and characteristics. Respondents were asked questions as shown in Figure 3.

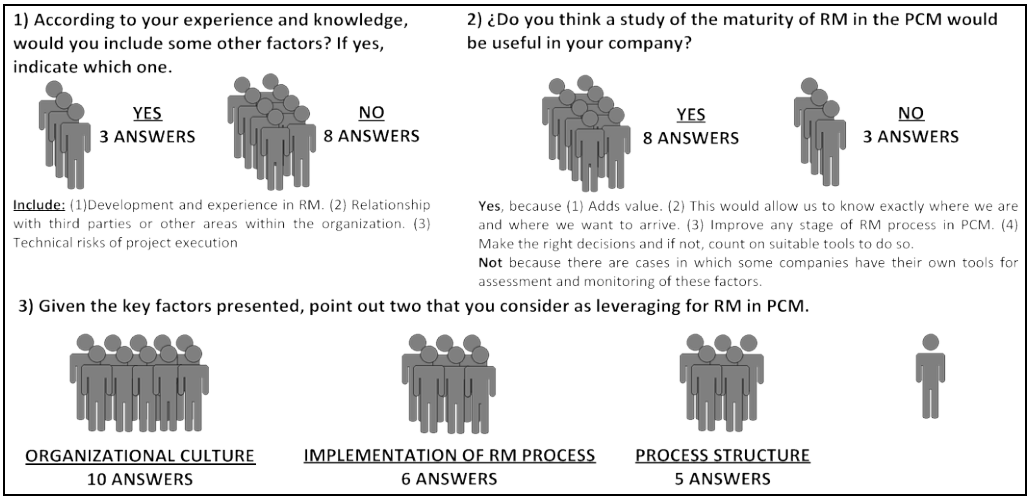

Figure 3. Responses to the questionnaire, designed by the authors, applied to the people involved in the PCM process.

The information collected from the responses to the questionnaire is very important because it allows us to know: (1) the feedback from participants about the key factors and the utility of this research, and (2) the leverage factor of RM in PCM.

DISCUSSION AND CONCLUSIONS

Key factors and leverage factors

It has been possible to establish a group of factors considering the fundamental aspects for the development of an effective RM in the PCM, achieving the integration and coordination of different business areas required for the development of this process, including characteristics of the organizational culture, organizational support for this process (training, use of technology, experts, resources, etc.), qualities and stages within the process of RM, and the involvement of stakeholders. In this manner,

we obtained: through the application of a questionnaire regarding what happens in practice, (1) a comparison of the key factors, dimensions and their characteristics. Then, based on the experience and knowledge of respondents, the factors were reaffirmed as key for RM process in the PCM, also, the comments left by the respondents were used to better define the characteristics and scope of dimensions of some factors; (2) an identification of leveraging factors of RM in the PCM by using the insights of people involved in the PCM process in mining companies. As key factor, the organizational culture stands out as the principal leveraging factor in RM (45.5% of respondents), followed by the implementation of the RM process (27.3% of respondents) and process structure (22.3% of respondents). Although these results are not useful to generalize since the survey is not a representative sample, we can conclude that it has validated the statement that the key factors obtained as a result of the research are not far from the actual situation of the companies.
Thus, we reaffirm the existence of four key factors for RM in the PCM, which correspond to (1) organizational culture, (2) structure of the process, (3) development and experience of RM and (4) implementation of RM process in the PCM.

Analysis of the existing risk maturity models
Regarding the study of maturity models applicable to RM, we can observe that there are different proposals for general maturity models for RM, but none focused exclusively on RM in the PCM. In many cases, these are briefly described and not clearly defined. Among them, there are the ones with certain similarities and common approaches, others that are complementary within themselves and also others with individual contributions. On a general basis it has been possible to find: (1) Models showing unique factors mainly cover dimensions regarding organizational culture, but none of the models is able to integrate the dimensions in order to fully structure this key factor. (2) In models that share elements, the ones related to the implementation of RM process are highlighted; this may occur because in the source of references there are a wide variety of manners to implement the RM, which in one way or another, converge into a general process. (3) Within the factors of the models that are complementary, the structure of the process becomes especially important regarding topics related to the development and incorporation of stakeholders in the RM process and the support to the decision making thanks to the information generated by the RM process. In addition, the key factors outlined in the previous analysis clearly match with the results regarding the leveraging factors of RM obtained by applying the questionnaire which reaffirms and connects the focus of source of references with the practice in the surveyed companies.

Awareness about risks and RM in PCM
The understanding regarding the awareness about risks and RM has been achieved, which allows identifying that the managers in the consulted companies are indeed aware. However, this remains only at this level and has not been transferred down to employees. The situation is most disturbing when knowing that one of the participants believes that neither employees nor managers are aware of neither risks nor RM in the PCM, showing a basic state of the RM in the PCM. This leads us to infer that there is not yet awareness regarding RM in the PCM, its benefits and the need of a structured system to address this area of management.
We believe that the diffusion of the knowledge of the identified factors will collaborate to strengthen the required awareness and will improve the performance of RM in the PCM in the companies. Overall, we observed that the interest and usefulness of an assessment model of RM in the PCM is high. Up to 72% of

respondents think it would be useful to apply a RM assessment system in the PCM, while the remaining percentage said it would not be useful, since in their companies has already been carried out an assessment. This leads to the second stage of this research, which seeks to develop a RM assessment and monitoring system for the PCM based on the identified key factors and their general levels of assessment, delivering a set of best practices to be implemented.

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RISK MANAGEMENT STRUCTURE FOR VALUE-BASED COMMODITY CONTRACTS

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ABSTRACT

The nature of a commodity implies that price is its primary differentiating factor. However, organizations increase their risk when they assume that the supply chain which delivers the goods is also a commodity; they select suppliers on the basis of lowest price. Organizations that award commodity contracts in this way may experience project delays, lack of effective communication, or customer dissatisfaction. The delivery of furniture services is often considered a commodity service. Arizona State University, on behalf of the Arizona Tri-University Furniture Consortium, identified concerns with their current furnishing services contract: misaligned customer expectations, minimal furniture supplier upfront involvement on large capital construction projects, and manufacturer design expertise not being utilized during project preplanning. The researchers developed and implemented a model that (1) provides a more efficient methodology for financial evaluation, (2) measures customer satisfaction, and (3) monitors project performance. The system has resulted in a 9.3 / 10 customer satisfaction rating (24 percent increase over the previous system), for over 1,100 furniture projects totaling $19.3M.

Keywords: best value model, commodity contracts, facilities management, furniture services industry, performance measurements

INTRODUCTION

The objective of this paper is to address the unrealized efficiencies buyer organizations can achieve by using a structured approach to identify and minimize risk. An area of significant potential improvement is in the selection and delivery of services that are perceived to be a commodity. Because commodities have minimal distinguishing characteristics, price is used as the deciding factor for which product or service to purchase (Rayburn, 2010; Reimann, Schilke, & Thomas, 2010; Rushkoff, 2005). When a buyer incorrectly assumes that price alone is a sufficient data point to make a decision, they expose their organization to risk that could have otherwise been minimized by considering additional factors besides cost alone (Gransberg, 1996; Kashiwagi & Savicky, 2003); we define this buyer behavior as exhibiting a "commodity mentality."

Problem

Large organizations inherently face increased difficulties in maintaining high levels of efficiency; that is, to create the greatest impact with the least amount of resources (Efficient, n.d.; Snyder & Morris, 1984).

The concept of organizational silos can be extended to the supply chain. Individual nodes along the supply chain that are operating in silos would not consider the profitability, efficiency, and interoperability of their value-adding functions as it relates to the rest of value chain (Blount, 2008; Katunzi, 2011; Milligan, 1999).

In an effort to meet their own performance goals, silos may use lower-cost suppliers, ignore the needs of the final end customer, and assign inadequate resources to new products and service design (Katunzi, 2010). Therefore, the nature of a large bureaucratic organization may foster "commodity mentalities" towards the entire supply chain that delivers goods and services which are (incorrectly) perceived to be "commodity."

Hypothesis and Paper Objectives

The purpose of this research was to test the applicability of a value-based risk management system in services which are typically viewed to have limited and quantifiable differences, with exception to price (commodities). The hypothesis was that implementing a best value business and leadership structure at the final buyer's position in the supply chain will increase upstream performance, and thereby result in increased performance at the buyer's site. The objective of this paper is to document the impact of a Best Value business leadership and risk management structure for a service that is typically perceived as a commodity (furnishing services).

Research Scope

In 1994, the Arizona Board of Regents (ABOR) mandated that the Arizona's three largest public universities (Arizona State University (ASU), Northern Arizona University (NAU), and the University of Arizona (UA)) abide by the Tri-University Furniture Contract (Tri-U Contract or Tri-U). The researchers utilized a best value selection and contract management processes called the Performance Information Procurement System (PIPS) (About PBSRG, 2012).

In July 2008, ASU's key staff approached the researchers and requested assistance to improve the delivery and performance of the Tri-U Contract. An interview with these individuals identified the following problems with the current Tri-U system:

- Customers do not always receive at the end of a project what was originally expected
- Lack of communication between the Capital Programs Management group, general contractors, furniture installation service providers, and University Business Services personnel
- Lack of performance measurements in terms of risk (on-time, on-budget)
- Lack of performance measurements in product deficiencies
- Manufacturer design expertise is not fully utilized during project pre-planning

Based on these problems, the researchers identified that the University may be using a commodity mentality towards the management of the Tri-U Furniture Contract. Upon further discussion with the ASU key staff, the researchers proposed that PIPS may have new application in the field of risk management of services typically perceived and managed as "commodity."

LITERATURE REVIEW

This brief literature review frames the concept of Performance Information (PI) and its use within organizations. Next, the review covers the role of PI in the processes that Facility Managers use to minimize risk. Finally, the researchers consider the special case of risk measurement in "commodity" services.

Use of Performance Information

Performance information, balanced scorecard results, and key performance indicators can be useful data to predict current or future performance of a company. A 1999 case study found that nonfinancial performance metrics in the airline industry (such as on-time flights or mishandled baggage) had a significant impact on future financial performance of the airline (Behn & Riley, 1999). Organizations may begin using non-financial metrics when their traditional processes or metrics no longer add meaningful value (Fakhri, Menacere, & Pegum, 2011). While the Facilities Management function is making progress, it still lacks adequate customer satisfaction information that is readily available (Tucker & Pitt, 2009).

Companies may also begin using data to increase performance in an effort to encourage personnel accountability. Hatry (2006) also identified that performance metrics help managers better allocate their limited resources. An effective metric simply identifies the risk an organization faces, which allows leaders to make adjustments to increase efficiency. Finally, Hatry (2006) identifies that performance measurement systems must produce accurate data from the beginning; not doing so may lead to decisions based on faulty information, and ultimately loss of confidence in the measurement system.

Facility Managers' Risk Management Process

Risk is defined as anything that affects time (schedule delays), cost, or customer satisfaction (Kashiwagi, 2002). In a broad business context, risk is anything that affects financial operations, and risk management is the process of preventing events from affecting such operations (Kraman & Hamm, 1999). While these definitions of risk are more measureable when applied to a project that has defined a cost and duration, understanding risk in a Facilities Management functions requires a different perspective.

The literature reveals a general three step approach to risk management. The first step is that FMs must measure their performance to get an accurate snapshot of reality. Tucker and Pitt (2009) suggest that it is especially important for FMs to measure performance in a variety of key areas that include both the financial and 'intangible'

aspects of their profession. Measuring different areas of performance helps organizations have a well-balanced approach to setting and monitoring their objectives.

The next step is to assess the probability of the risk occurring, and to develop plans that minimize the risk (Alexander, 1992). The key in minimizing the risk is to plan ahead before the risk actually occurs (Boehm, 1991). Facility Managers should also address any activity that could harm the financial viability of the organization (Barton & Hardigree, 1995). More recent literature suggests that FM departments should focus on the risks (or metrics) that have an impact on the value they add to the organization (Cotts 2010). Regardless of how a facilities manager views the type of risk to be managed, the common theme from the literature is to plan ahead before the situation arises.

An alternative approach to risk management, found as a component of the PIPS, is to transfer the risk and accountability to the expert (Sullivan & Guo, 2009). The philosophy can be used by Facility Managers to better manage their areas of responsibility. The PIPS process identifies that risk should be managed in the following manner (Kashiwagi, 2012a; Sullivan & Guo, 2009):

1. The expert should first identify what their overall plan is to complete the project.
2. They should then address anything that could stop them from being successful on the project, and provide a simple plan how they will minimize the potential risks.
3. Once the project or service has begun, the expert vendor should track any changes from their baseline expectation.

The actual process of transferring the risk to the expert occurs when vendor completes these steps, and the owner releases control and accountability to the vendor.

Risk Measurement of Commodity Services

A commodity, in its simplest definition is, “a mass-produced unspecialized product” (Commodity, n.d.). Generally, “commodification” refers to the practice of assigning a market value to a good or service that it did not previously have (Rushkoff, 2005). “Commoditization”, on the other hand, is the process where a good or service previously has distinguishing attributes and limited quantities, and becomes mass-produced and nearly identical, with price being the primary differentiating factor (Rayburn, 2010; Reimann, Schilke, & Thomas, 2010; Rushkoff, 2005).

Goldsby and Rao (2009) categorize the general types of risks that a supply chain may encounter:

1. Environmental factors – issues that affect the overall environment or situation that supply chain operates (politics, society, etc.).
2. Industry factors – issues within the market that the product is being sold.
3. Organizations factors – issues relating to the firm level, including behavior and research and development.

4. Problem-specific factors – issues relating to single issues that affect the entire supply chain.
5. Decisions-maker factors – issues relating to an executive, or steering committee, and the individual's or committee's level of expertise in making the decisions.

Production uncertainty is the only issue mentioned above relating specifically to the product delivered to the buyer. Therefore, the literature indicates that most supply chain risk is not related to the actual product being delivered, but risk is in the processes or systems that supply the good.

METHODOLOGY

The researcher divided the research methodology into two main phases. The first phase gathered background information and current conditions of the Tri-U Furniture Contract. The second phase used the results of phase one to develop a Request for Proposal (RFP), identify the potential best value vendors, and require the vendors to develop a detailed plan for their approach to manage and minimize contract deviations and risk.

Phase One

The primary objectives of phase one was to:

1. Meet with the industry to gauge interest in, and support for, a best value approach to furniture contract procurement and delivery
2. Identify the current conditions of the existing Tri-University Furniture Services environment

With permission from the University, the researcher coordinated and provided an optional best value information session to approximately 50 people from the furniture industry. The key factors discussed during the meeting were:

- The post-award purchasing structure needed to include a component that allowed buyers to make match-existing product purchases.
- Not all potential proposers have a State of Arizona furniture contract, and therefore, an evaluation criterion that considered list-price percentage discounts from the State contract could not be used.
- The proposers would like the ability to indicate if they were proposing on the budget or primary contract.
- ASU needed to provide historical purchasing levels for the different universities, and which contracts these purchases were made on.

Phase Two

Using the information gathered from Phase One, the researchers and the senior buyer from the ASU's Purchasing Department compiled the Request for Proposal (RFP). This RFP was the University's first furniture RFP that incorporated best value procurement methodologies, and as such, there were several differences from a traditional furnishing services RFP. In general, the Traditional RFP does not

specifically consider the proposers' ability to manage and minimize risk that would stop them from being successful on a project-by-project basis. The RFP established three different types of projects that the Universities have (Match-existing, Capital, Non-capital).

RISK MANAGEMENT STRUCTURE

Recall that the existing furniture purchasing process was totally void of performance monitoring and risk minimization protocols. The new best value approach contained tools to help monitor and minimize risk:

Table 3.4 – *Risk Management Tools*

Risk Management Tool	Description
Project Record List (PRL)	List of Small Projects that tracks cost, schedule, client contract information, client satisfaction, and any cost or schedule risks
Weekly Risk Report (WRR)	Used on a single Large Project and tracks detailed project information, cost, schedule, risks, and a Risk Management Plan

The updated purchasing process is described below:

- As in the previous RFP, the furniture purchasing process begins with a buyer need. Regardless of the Project Type, the Total Projected Cost is used to determine the Project Size.
- If the project is a Small Project, the Dealer first adds it to their Project Record List. They will then begin work on the project and document any risks that occur on their PRL. At the conclusion of the project, the Dealer is responsible for collecting a simple survey from the end client.
- If the project is a Large Project, the first, and most important step the Dealer takes is to modify their base RMP template (developed during the Pre-Award Phase), and ensure the client understands the dealer's Risk Management Plan. At the conclusion of this initial phase, the dealer holds a Summary Meeting with the client that recaps their RMP, the project schedule, and action items. As the reader may have noticed, this is in fact a smaller version of the Pre-Award Phase from the PIPS process. After the Summary meeting, the vendor moves forward as they normally would on a Small Project, and document risk and client concerns through the duration of the project. At the project conclusion, the dealer collects a more extensive, one-page client survey.
- All client satisfaction surveys are used in the vendor's Past Performance Information Database.

The structure is a system-wide mechanism that monitors each project, at each University, for each dealer. All project and risk data becomes part of the Best Value Information System, and serves the University system through the use of risk reporting tools, risk minimization, and performance monitoring and tracking.

DATA COLLECTION AND ANALYSIS

Client satisfaction increased by 24.3 percent under the best value system (as compared to the previous system). This increase in satisfaction was confirmed through rejecting a null hypothesis that there was no differential between the systems ($\alpha = 0.05$; H_0: $\mu_1 - \mu_2 = 0$; H_1: $\mu_1 - \mu_2 \neq 0$; p-value = 1.84E-21). The summary of client satisfaction is provided in Table X below.

Table 4.3 – *Summary of University Performance Differential*

No	Performance Criterion	Unit	Overall	ASU	NAU	UA
1	Baseline Overall Performance	1-10	7.02	7.23	6.35	7.43
2	Best Value Overall Performance	1-10	9.26	9.34	9.24	9.19
3	Baseline Satisfaction	%	77%	89%	50%	91%
4	Best Value Satisfaction	%	99%	100%	100%	98%

SUMMARY OF RESULTS AND CONCLUSIONS

The primary objective of this paper was to propose a more efficient approach to minimize and manage risk of "commodity" services. The best value Tri-University Risk Management Structure contains tools to help the suppliers manage the risk, and report this information back to the client. In short, the major conclusions of this research are:

- There is significant value in managing risk, even if the service is typically perceived as "commodity"
- A structured pre-planning methodology can be incorporated into a structure, which in turn helps all parties to coordinate
- Customer satisfaction under the best value has increased by 24.3 percent

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SUPPLY CHAIN MANAGEMENT STRATEGIES FOR ENGINEERED-TO-ORDER TIMBER STRUCTURAL SYSTEMS

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ABSTRACT

Supply Chain Management (SCM) originated in the manufacturing industry and then in the construction industry in the mid 1990s. SCM is the management of the entire supply chain instead of individual parts or processes. Its aim is to deliver improved transparency and alignment of the industry's supply chain coordination and positively influence time, cost and quality aspects. Time and cost are important factors that developers and clients use to measure the success of projects. Prefabricated timber structural systems for multi-storey construction are a new innovation, as such time and cost aspects are critical to their commercial viability in the construction industry. They are an engineered-to-order (ETO) product and most SCM literature has neglected the needs of the ETO sector, in particular prefabricated timber structural systems. This paper aims to review the current state-of-art of SCM used in construction and discuss how it can best be adopted for prefabricated timber systems with a focus on improving time and cost. Semi-structured interviews were conducted with industry professionals across the supply chain of timber construction with the aim of identifying which areas of the supply chain have the greatest impact on time and cost. SCM strategies are then suggested to address these areas.

Keywords: Construction, Supply Chain Management, Engineered-to-order, Time and Cost

INTRODUCTION

Timber has great potential in multi-storey buildings due to its high strength to weight ratio, environmental attributes and ability to be prefabricated into lightweight modules. Cross Laminated Timber (CLT) is an example of this construction typology and has proved to be successful in Europe in multi-storey residential construction and is gaining interest throughout the rest of the world (Perkins & McCloskey 2010).

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EXPAN is another prefabricated timber construction system that has been developed for non-residential building applications and is gaining momentum in the Australian and New Zealand (NZ) markets. There's a potential multi-million dollar market for prefabricated systems in multi-storey construction in Australia and NZ and the demand for such products is being driven by worldwide interest in sustainable building materials and modular construction. Prefabricated timber systems are more environmentally friendly than traditional forms of construction (Page 2006; Perez 2008 & John et al. 2011) though traditionally multi-storey commercial buildings have been constructed out of steel and concrete. This has been facilitated by designers and contractors familiarity with these materials, low on-site labour costs and ability of these systems to span the long distances required in commercial applications.

In this paper semi-structured interviews were conducted with a number of industry professionals throughout Australia, NZ and Europe and results showed that the environmental and aesthetic aspects of timber were considered as 'soft factors'. In order for new prefabricated timber structural systems to be truly commercially viable they need to be time and cost competitive with traditional forms of construction. Well-managed and efficient supply chains (SCs) between the firms producing these systems was highlighted as critical in achieving these cost and time benefits. Firms in all sectors are looking for ways to reduce costs, shorten product development times and manage risk. Firms in supply chains have a number of transactions that aim to add value upstream. Supply chain management (SCM) seeks to reduce the costs, risk and lead times of these transactions that result in increased value to the end customer. This paper looks into the current-state-of art of SCM in construction with a focus on ETO prefabricated timber systems, which have been neglected to date in literature. The business models of a number of firms delivering prefabricated systems are outlined and a comparison is conducted between these firms operating in Europe, Australia and NZ. This paper also provides SCM strategies for firms in Australia and NZ to assist in achieving a more cost and time effective procurement of these systems into the non-residential construction market.

Supply chains in Construction

An SC is defined as 'a network of organisations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services' (Christopher 1998 pg. 15). Until the 1980s procurement in the construction industry was based on transactions between one buyer and one seller. These transactions were used to meet specific project needs and were typically adversarial in nature and based on arms-length relations. Towards the end of 1980s firms involved in construction projects started to develop internal integration, which was then followed by the goal of external integration. This was achieved through engineering and construction firms integrating with their first tier suppliers. SCM is a concept that was developed from innovative models such as Just-In-Time (JIT) and originated in the manufacturing industry (Vrijhoef & Koskela 2000). It takes the integration initiatives to the next level with the aim of managing 'upstream and downstream relationships with suppliers and customers to deliver superior value at less cost to the supply chain as a whole' (Christopher 1998 pg. 15).

Vollman, Cordon & Raabe (1998) suggested that the construction supply chain should be an integrated set of practices aimed at managing and co-ordinating the whole supply chain from raw material acquisition right through to the customer. SCM seeks

improved performance through better use of internal and external capabilities in firms to create a seamlessly coordinated supply chain, thus elevating inter-company competition to inter-supply chain competition. SCM represents one of the most significant paradigm shifts of modern business management by recognising that individual businesses no longer compete as solely autonomous entities, but rather as supply chains (Chen & Paulraj 2004). SCM involves effective coordination and collaboration between all the parties involved in the supply chain, and tight-knit business relationships are central to the success of the supply chain network. The concept of business networks is known as 'relationships between businesses where the chain of connectedness is without limits and can span several relationships that are indirectly connected. It is closely tied to the concepts of partnerships, strategic alliances, and other cooperative relations with supply chain members (Bechtel & Jayaram 1997). The business relationships between supply chain partners and customers are especially important to manage and maintain, as the operation of a business is heavily reliant on incoming materials supply, the supply of information, distribution of products, and market demand.

Supply Chain Management (SCM) & Engineered-to-order (ETO) products

There has been limited operations and SCM research to date on the ETO supply chain (Hicks, McGovern & Earl 2000; Gosling & Naim 2009). The ETO supply chain is generally associated with large project based environments such as construction and capital goods. It is characterised as having the 'decoupling point' located at the design stage, so each customer order penetrates the design phase of a product (Gosling & Naim 2009). ETO products are typically highly customised as each individual order is produced in low volumes to meet individual project requirements. There is very limited research on the supply chain of prefabricated timber products. A number of studies have looked into ETO products from a supply chain perspective, including HVAC ductwork (Holzemer, Tommelein & Lin 2000) prefabricated concrete elements (Vrijhoef and Koskela 2000), transformers (Tommelein, Walsh & Hershauer 2003) and switchgear (Barker 1994).

Traditionally SCM has concentrated on high-volume manufacturing such as the automotive industry. In these high-volume industries the focus has been on the mass production of standardised products in routine and repetitive assembly processes. Four key trends have been identified including outsourcing of non-core activities, focusing on operations, reductionist in supplier base and establishment of long-term collaborative relationships with suppliers (Hicks et al. 2000). Research focuses on supply chains in which power is held by the focal producer who is typically able to exert a large degree of control over its smaller suppliers (Bresnen 1996). In ETO firms, relationships with suppliers differs considerably depending on different levels of vertical integration; variations in volume for different types of components; the degree of customisation of components; level of engineering required; proximity to critical path and the power balance between buyer and suppliers (Hicks et al. 2000). ETO firms are typically low volume producers in project-based environments, which means it is difficult to simply transfer SCM practices that were successfully adopted in high volume manufacturing industries.

Data collection and analysis

In this paper data collection was achieved through semi-structured interviews with 28 industry professionals with experience in prefabricated timber systems in Europe, Australia and NZ. The interviews were conducted in two rounds. Round one involved

semi-structured interviews to establish what are the major factors that effect the time and costs of prefabricated timber systems in non-residential construction. A thematic analysis was performed and a number of issues were highlighted. In Europe the major issues were ensuring good communication between building contractors and timber contractors. Bad weather and transportation/logistics throughout Europe were also highlighted as key issues that could effect time and costs. In Australia and NZ timber has traditionally been used in residential construction, with very little use in the non-residential market. It was outlined that a number of factors such as building code requirements, design and detailing, fabrication and installation capacity as being key factors. In Europe it was considered the supply of materials wasn't specifically an issue as there were a large number of firms that are vertically integrated and has enough production capacity to supply systems. In contrast in Australia and NZ it was highlighted that there is very little capacity of firms along the supply chain to procure prefabricated timber systems to the market at a competitive cost, time and quality.

Round two interviews were undertaken with 6 of the firms involved in the supply of prefabricated timber systems. Business models of a number of firms involved in the delivery of these systems are outlined in Table 1 and 2. When comparing models between firms in Europe, Australia and NZ it is important to highlight the different markets. Prefabricated timber systems have been produced in Europe significantly longer than Australia and NZ. With glulam being manufactured and fabricated into large structural components in Europe for over 100 years and CLT for around the last decade or so. Compare this to Australia where LVL has been manufactured for a couple of decades, and glulam since the early 1950's, though it has been labelled as a 'cottage industry'. Not only have timber systems been in manufactured for a significantly longer period of time in Europe, though the market is substantially larger. This large market allows a number of firms to be vertically integrated and offer a fully integrated solution to customers (see Table 1). Feedback from interviews highlighted that offering this 'solutions approach' is important in achieving time and cost objectives particularly in non-residential construction projects.

Table 1 - Different services offered/business models of timber companies in Europe

	Structural timber manufactured /fabricated		**Services offered**				
	CLT	Glulam	Full structural engineering design	Detailing /shop drawings	Design integrates with CNC	Logistics	Installation
Firm 1 (Italy)	X	✓	✓	✓	✓	✓	✓
Firm 3 (Switzerland)	✓	✓	✓	✓	✓	✓	X
Firm 4 (Austria)	✓	✓	✓	✓	✓	✓	X
Firm 5 (Austria & Germany)	✓	✓	✓	✓	✓	✓	X
Firm 6 (Austria and UK)	✓	X	X	✓	✓	✓	✓

In Australia and NZ the largest firms involved in timber construction are focused on commodity production for the residential construction market. This has occurred as there were no timber structural solutions available to compete with steel and concrete in non-residential construction so they were unable to penetrate this market. With the advent of new innovative prefabricated structural timber systems including EXPAN and CLT in Australian and NZ markets, timber products can have the opportunity to compete with traditional forms of construction in non-residential construction.

Table 2 - Different services offered/business models of timber companies in Australia & NZ

	Structural timber manufactured/fabricated		**Services offered**				
	Glulam	LVL	Full structural engineering design	Detailing /shop drawings	Design integrates with CNC	Logistics	Installation
Firm 1 (Australia/ NZ)	X	✓ (Manufacturing ONLY)	X	X	X	X	X
Firm 2 (Australia)	X	✓ (Manufacturing ONLY)	X	X	X	X	X
Firm 3 (NZ)	X	✓ (Manufacturing ONLY)	X	X	X	X	X
Firm 4 (Australia)	X	✓ (Fabrication ONLY)	✓	✓	✓	✓	X
Firm 5 (NZ)	✓ (Fabrication ONLY)	✓ (Fabrication ONLY)	X	✓	X	✓	X
Firm 6 (Australia)	✓ (Fabrication ONLY)	✓ (Fabrication ONLY)	✓	✓	X	✓	X

In the non-residential construction market traditional prefabricated solutions such as steel and prefabricated concrete have been delivered as a complete ‘solution’ to head contractors. Integrated models encompassing design and detailing, manufacturing/fabrication and installation are standard practice amongst these firms. In Europe timber companies supplying the non-residential market have similar models. In Australia and NZ the commercial construction environment is substantially different to the residential market, and if firms are to going to be successful in producing these new innovative systems time and cost competitively they need to structure their business’s to suit. Structural contingency theory outlines that there should be a fit between the organizational processes and the environment (Burns & Stalker 1966 and Lawrence & Lorsch 1967). It outlines that company models that match the environmental requirements should perform more successfully than those that don’t and under-performing companies may decide to adopt a new business model that better fits the environment. Research indicates that it requires significant capital costs and time to establish structural changes in organizational configurations and as a result companies rarely undertake the process. Large capital costs are typically required for vertical integration (VI) and this strategy is typically most suited to stable and mature environments. ‘The idea of VI is anathema to an increasing

number of companies. Most of yesterdays highly integrated giants are working overtime at splitting into more manageable, energetic units – i.e. de-integrating. Then they are turning around and re-integrating – not by acquisitions but via alliances with all sorts of partners of all shapes and sizes' (Grant 2007). Using these ideas as a base there is the possibility of adopting SCM strategies between a number of firms in the supply chain to offer an integrated 'solutions approach' for prefabricated timber systems.

SCM strategies

One of the most revolutionary changes over the past decade to affect the strategic management of supply chains is the rethinking of organisational structure to suit the demands of the market (Christopher 2011). In order to respond to market demands, organisations have restructured and a new form of organisation has emerged, where the supply chain is used as an extension of the organisation. When applying structural contingency theory to SCs it is suggested that the individual dimensions of the SC should be aligned in order to achieve the best fit for a particular environment. SCM initiatives such as partnering, strategic alliances, and joint ventures can be adopted to integrate the supply chain with the primary goal of increasing value for the end customer through achieving time and cost savings and quality improvements. There is growing evidence to suggest that supply chain integration can have a positive impact on operational performance outcomes such as delivery times, cost and quality (Rosenzweig, Roth & Dean 2003; Droge, Jayaram & Vickery 2004 & Flynn, Huo & Zhao 2010)

Partnering and the creation of strategic alliances could be used as short-term strategy for the prefabricated timber supply chain in Australia and NZ. This could help drive time and cost efficiencies, and offer the opportunity to achieve the closeness and co-ordination efficiencies similar to vertical integration without having to outlay significant capital investments (Beach, Webster & Campbell 2005). Partnerships and alliances between manufacturers, fabricators and designers could streamline the current fragmented SC and help minimise waste and delays. SCM literature typically limits supply chain integration to suppliers, although for ETO products the decoupling point' is located at the design stage, so each customer order penetrates the design phase of a product (Gosling & Naim 2009). For prefabricated timber systems it's important that the design team in particular the structural engineer have a close relationship with manufactures and fabricators to get a better appreciation for each other's challenges/problems, and capabilities. This collaboration will help drive better building designs and increased value to clients. A medium to long-term strategy could be for firms in the Australian and NZ industry to vertically integrate, similar to the business model of firms in Table 1. This long-term strategy of VI will be market driven and until there is a guaranteed stable market demand for such systems vertical integration by the one firm isn't a commercially viable option.

CONCLUSIONS

Prefabricated engineered timber structural systems for multi-storey non-residential construction are a new innovation to the construction industry in Australia and NZ and ensuring these systems can be delivered at a competitive cost and time is imperative to their successful commercialisation into the construction market. The supply chain for these systems is fragmented and primitive in nature. This is due to the lack of market demand for such systems. As a result firms haven't adopted the

organisational structures necessary to produce these systems effectively. Lessons can be learned from European timber firms as well as local steel firms whereby providing a complete solution approach to head contractors is critical to meeting commercial market needs and expectations. Firms in Australian and NZ could adopt SCM strategies such as partnering and strategic alliances to create an integrated supply chain for ETO prefabricated timber products. This research has made a number of discoveries, namely what the key issues are in relation to the delivery of prefabricated timber systems in Australia and NZ. It also established that the differences in business models between European, Australian and NZ firms involved in the delivery of prefabricated timber systems is due to market environments. Using structural contingency theory as basis this research outlined that by adopting SCM strategies such as partnering and alliances, firms along the SC can be restructured and create a new form of organisational form where the SC is used as an extension of the organisation. This will allow a fit between the organisational processes and the environment, and allow prefabricated timber systems the opportunity to meet the needs and expectations of the commercial market.

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TENDER RULES AND TRUST INFLUENCE ON CO-OPERATION IN THE BUILDING INDUSTRY

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ABSTRACT

The building industry has for many years been criticized for not having as efficient and effective co-operation as other industries. Some parties in the building sector try to use a new form of collaboration as i.a. partnering. In a big part of those partnering projects a good working relationship exists, the building owner is satisfied, the involved companies earn money and the project finish in time. A lot of projects do not use partnering or other new forms of collaboration. In these projects the general impression is that the parties in the building sector are fighting instead of co-operating. A questionnaire survey including building owners, contractors, suppliers, architects, engineers and client design advisor has been accomplished. The survey shows that the problem with co-operation among others is the way the tendering rules normally are used, where the normal assignment criterion is the lowest cost instead of the economically most advantageous bid. The involved parties do not always trust each other; the parties are not good enough at involving each other in the beginning of a project and the building sector is not ready enough for new forms of collaboration initiatives.

Keywords: assignment, co-operation, legislation, trust.

INTRODUCTION

The building sector is frequently described as conservative and tradition-bound, which according to critics results in little innovation, a not very efficient and effective cooperation and bad economy compared with other industries. (Akintola, et al. 2000, Cheung, et al. 2009, Dansk Byggeri 2006, Kadefors 2004, Wandahl, Cankaya et al. 2011)

Building projects involve to more or less extent a wide range of stakeholders. Some stakeholders can be one and the same person, others do not necessarily have a big influence on each building project, but they will be affected by the project. In the Danish case, the most essential stakeholders are the owner, the client design adviser, the architect, the engineer, the contractor and the supplier, who have the biggest influence on each building project, and they also have the biggest interest in the form of the project as it affects the economy in their companies.

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A traditional way of making a building project in Denmark is to organise it in five different phases: the planning phase, the project designing phase, the tendering phase, the construction phase and the operating phase respectively. This traditional way of organising a building project normally implies that some of the stakeholders are involved in the beginning of the project, others in the middle and the rest in the end of the project. This phase partition frequently results in none or a bad communication between the different stakeholders, which results in suboptimization of the economy. (Wandahl et al., 2007)

Until 2001 a Competitive Tendering Act existed in Denmark where you had to use price as criterion. This law still impact on part of the parties/stakeholders, therefore a big part of the building projects has seemingly put out to tender as a lowest price bid instead of an economically most advantageous bid. That again means that the parties are using traditional forms of contracts as contract awarded on a trade-by-trade basis, general contract and turnkey contract instead of using new forms of contracts as for instance partnering (Faber Ussing et al., 2011).

Another tradition in Denmark is to make one of a kind production. For a Dane it is important to have a building which differs from all other buildings, which results in new ways of building, often with a new composition of parties/stakeholders in the project.

Partnering and Lean Construction are some of the new ways of organising a building project to change the old traditional way of making a building project. Partnering and lean are ways where you try not to suboptimize on the economy but instead have common goals, a common vision, make the parties take common ownership and create a good communication between the parties involved in the project. (Ebbesen et al. 2007)

RESEARCH METHODOLOGY

The purpose of this paper is, by means of a hypothetical deductive method, to seek partly answer of the research question; *which contributory factors characterize the building sector as without good economy, efficiency and effective cooperation compared with other industries.* However, an inductive method is used in the survey. (Føllesdal, 2005)

Survey

To answer the research question two students from the M.Sc. in Construction Management at Aalborg University in Denmark have in their master dissertation conducted a questionnaire survey.

The idea was to use the most essential stakeholders: the owner, the client design adviser, the architect, the engineer, the contractor and the supplier as respondents in the survey. The respondents were intended to be selected with a comparative equal distribution between the six interest groups, and thus the respondents represent small, medium and large companies.

The survey was intended to be quantitative. Contact information was collected from 395 respondents in Denmark, whose designation of occupation fit in proportion to one of the six interest groups.

The survey is composed in SurveyXact which is an online analysis implement. The questionnaire was send to and accepted by 359 persons distributed as follows: 45 owners, 47 client design advisers, 68 architects, 74 engineers, 71 contractors and 54

suppliers. Hereof 163 respondents accomplished the questionnaire, 40 respondents partly accomplished the questionnaire and 156 did not answer the questionnaire.

The decision was only to use the 163 respondents who accomplished the full questionnaire. The grouping of the 163 respondents who accomplished was 21 owners, 31 client design advisers, 33 architects, 25 engineers, 36 contractors and 17 suppliers.

In the questionnaire the respondents first had to answer a question about which part they represent in the building sector. This was asked to be able to distinguish the subsequent questions according to which part the respondents represent. To the subsequent questions the Likert scale was used (Faarup et al., 2010).The questionnaire consists of 83 questions related to the research question; which contributory factors characterize the building sector as without good economy and without efficient and effective cooperation compared with other industries. Only the most unambiguous answers have been included in this paper.

FINDINGS AND DISCUSSION

Cooperating

Some of the questions in the survey were related to cooperating in the building sector. These questions shall clarify the respondents' general approach to cooperating in the building sector; if the respondents think it is possible to improve cooperation and find that good cooperation has an influence on a project economy.

The respondents were asked; 'To which extent do you think problems exist in the cooperation between the parties in the building sector?' The results in table 1 show that 63% of the respondents think problems exist in the cooperation to a great extent or a certain extent, but for the owners only 71% find that problems exist to a certain extent. Since the owner is a client in the building sector, the opinion of the owner is of paramount interest for cooperation.

Tabel 1. Cooperation between the parties in the building sector – To which extent do you think problems exist in cooperation between the parties in the building sector?

	Owner	**Client design adviser**	**Architect**	**Engineer**	**Contractor**	**Supplier**	**Total**
To a great extent	0,0% (0)	0,0% (0)	18,2% (6)	12,0% (3)	4,0% (1)	5,6% (2)	7,4 % (12)
To a certain extent	71,4% (15)	51,6% (16)	48,5% (16)	56,0% (14)	63,9% (23)	35,3% (6)	55,2% (90)
To a less extent	28,6% (6)	48,4% (15)	33,3% (11)	40,0% (10)	30,6% (11)	47,1% (8)	37,4% (61)
Not at all	0,0% (0)	0,0% (0)	0,0% (0)	0,0% (0)	0,0% (0)	0,0% (0)	0,0% (0)
Do not know	0,0% (0)	0,0% (0)	0,0% (0)	0,0% (0)	0,0% (0)	0,0% (0)	0,0% (0)
Total	21	31	33	25	36	17	163

Another question is; 'To which extent do you think it is possible to improve the cooperation?' To that question 39% answered to a great extent and 50% answered to a certain extent. Concerning cooperation and economy a question was; 'To which extent do you think that good cooperation has a positive influence on the project economy for the individual part of the building project?' To that question 66% answered to a great extent and 25% answered to a certain extent. This shows that cooperation is not optimal, but the respondents can see some opportunities and economic benefits by improving cooperation.

Matching of expectations

Another relevant topic is to find out to which degree the parties in the building sector match the expectations to each other in the project, obtain to a good cooperation without misunderstandings and mistakes.

Therefore the respondents were asked; 'To which extent do you think that matching of expectations between the parties in a building project can improve cooperation?' To that question 57% answered to a great extent and 33% answered to a certain extent.

The respondents all find that it is important to match expectations, but to the question; 'To which extent do you match expectations with the parties in a building project?' They are all asked this for every one of the five other parties. But the results of that question show, that even though they all find this important, they do not always carry it out in practice. The aggregate number for the parties is; Owner 78% to a great extent or a certain extent; Client design adviser 65% to a great extent or a certain extent; Architect 76% to a great extent or a certain extent; Engineer 70% to a great extent or a certain extent; Contractor 60% to a great extent or a certain extent; and Supplier 26% to a great extent or a certain extent. The disaggregate number shows the biggest match of expectations between the owner and the client design adviser, the architect, the engineer; a lower match between the advisers and the operating companies and the lowest match between the suppliers and all the others. The disaggregate number also shows that the suppliers think, they do a lower match of expectations to all others than all the other means they do the other way around.

Procurement rules

A topic of questions concern procurement rules. In this topic focus is on the influence of procurement rules on cooperation in the building sector, to which extent do the respondents think, that a change in the current procurement rules promote the cooperation between a building project's parties, and which assignment criterion is in the respondents opinion the most common for selecting parties in a building project.

The questions concerning procurement rules in table 2 shows that 61% find the procurement rules have a negative influence on cooperation in a building project to a great extent or a certain extent. The respondents were also asked; 'In which extent do you think that a change in the current procurement rules can promote cooperation between a building project's parties?' To that question 22% answered to a great extent and 36% answered to a certain extent. This shows that the main part of the respondents find, that the current procurement rules are not optimal, if a good cooperation is to be obtained.

Another question was; 'Which assignment criterion is in your opinion the most commonly used, when parties are selected for a building project? To that question 81%

answered, lowest price. This gives an indicator of that price and economy are very important for a lot of building owners.

Tabel 2. Procurement rules – To which extent do you think the procurement rules have a negative influence on cooperation between the parties in a building project?

	Owner	**Client design adviser**	**Architect**	**Engineer**	**Contractor**	**Supplier**	**Total**
To a great extent	23,8% (5)	12,9% (4)	15,2% (5)	12,0% (3)	16,7% (6)	35,3% (6)	17,8% (29)
To a certain extent	52,4% (11)	45,2% (14)	42,4% (14)	36,0% (9)	47,2% (17)	29,4% (5)	42,9% (70)
To a less extent	14,3% (3)	35,5% (11)	21,2% (7)	32,0% (8)	25,0% (9)	29,4% (5)	26,4% (43)
Not at all	4,8% (1)	3,2% (1)	6,1% (2)	12,0% (3)	8,3% (3)	0,0% (0)	6,1% (10)
Do not know	4,8% (1)	3,2% (1)	15,2% (5)	8,0% (2)	2,8% (1)	5,9% (1)	6,7% (11)
Total	21	31	33	25	36	17	163

Trust

Questions about trust in the building sector were a fourth topic in the survey. This topic was chosen to find out, to which extent the building sector is characterised by distrust, if trust can promote cooperation, and do the respondents think that it is possible to create more trust in the building sector.

One of the questions were; 'To which extent do you think the building sector reflects distrust between the parties on a building project?' To that question 18% answered to a great extent and 55% answered to a certain extent. The respondents were also asked to which extent they trust other parties in a building project. To that question the answers were; Owner 92% to a great extent or a certain extent; Client design adviser 75% to a great extent or a certain extent; Architect 88% to a great extent or a certain extent; Engineer 88% to a great extent or a certain extent; Contractor 59% to a great extent or a certain extent and Supplier 64% to a great extent or a certain extent. Those answers indicate some problems with trust between the parties in building projects. It also shows that the trust is highest between people who work closest together. It seems that trust is lowest between the parties in the construction phase. The answer shows that a big part of the owners (43%), the client design advisers (13%), the architects (42%) and the engineers (48%) have less trust to the contractor. The same is valid for the suppliers but not to such a explicit degree as for the contractors (owners 29%, the client design advisers 26%, the architects 24% and the engineers 48%)

The respondents were also asked; 'To which extent do you find that trust has a positive influence on cooperation between the parties on a building project?' To that question 79% answered to a great extent and 20% answered to a certain extent. Therefore it is important to create a trusting climate between the parties. Therefore the contractors and the suppliers have something to work with. Even if they just have a bad repu-

tation or there is a real problem; they are not as upright and trustworthy as others can wish.

Another question is shown in table 3. It shows that 76% of the respondents to a great extent or a certain extent find that it is possible to create more trust between the parties in a building project. It shows that there is a room for improvement of the trust level in the building sector.

Tabel 3. Trust in the building sector – To which extent do you think it is possible to create more trust between the parties in a building project?

	Owner	**Client design adviser**	**Architect**	**Engineer**	**Contractor**	**Supplier**	**Total**
To a great extent	9,5% (2)	9,7% (3)	24,2% (8)	8,0% (2)	36,1% (13)	17,6% (3)	19,0% (31)
To a certain extent	66,7% (14)	74,2% (23)	39,4% (13)	64,0% (16)	52,8% (19)	47,1% (8)	57,1% (93)
To a less extent	23,8% (5)	16,1% (5)	36,4% (12)	28,0% (7)	8,3% (3)	29,4% (5)	22,7% (37)
Not at all	0,0% (0)	0,0% (0)	0,0% (0)	0,0% (0)	0,0% (0)	5,9% (1)	0,6% (1)
Do not know	0,0% (0)	0,0% (0)	0,0% (0)	0,0% (0)	2,8% (1)	0,0% (0)	0,6% (1)
Total	21	31	33	25	36	17	163

Reciprocal understanding and respect

The last topic was to find out how the respondents consider the degree of reciprocal understanding and respect between the parties on one another's work.

The respondents were asked; 'To which extent do you find that reciprocal understanding and respect have a positive influence on cooperating in the building sector?' To that question 67% answered to a great extent and 32% answered to a certain extent. So it seems to be important to have a big degree of reciprocal understanding and respect between the parties.

But there is a problem because to the question; 'To which extent do you have experience with that the different parties do not have understanding and respect for you as a part of the project?' The aggregate answers are as follows: Owner 32% to a great extent or a certain extent; Client design adviser 44% to a great extent or a certain extent; Architect 37% to a great extent or a certain extent; Engineer 38% to a great extent or a certain extent; Contractor 47% to a great extent or a certain extent and Supplier 20% to a great extent or a certain extent. The disaggregate answers show that the respondents find that the contractors and suppliers have the lowest understanding and respect of the others work, the number from the owners is 47%, the client design advisers 58%, the architects 46%, the engineers 56% and the suppliers 25% to a great extent or a certain extent on the Contractor. The similar numbers on the suppliers are from the owners 35%, the client design advisers 47%, the architects 53%, the engineers 47% and the contractors 55% to a great extent or a certain extent. This shows that there is a problem about reciprocal understanding and respect between the parties on one another's work, especially between the advisers and the operating companies.

CONCLUSION AND FURTHER RESEARCH

The purpose of this paper was to answer a part of the research question; which contributory factors characterize the building sector as without good economy and without efficient and effective cooperation compared with other industries. To answer a part of the question a questionnaire survey was made inter alia the topics cooperating, matching of expectations, procurements rules, trust and reciprocal understanding and respect. The most essential stakeholders in the building sector; the owner, the client design adviser, the architect, the engineer, the contractor and the supplier were respondents to get a wide sense of the opinion in the building sector in Denmark.

The results of the survey show that the parties in the building sector think, there are problems with cooperation on a building project. It was also widely agreed that it is possible to improve cooperation, and that a good cooperation has a positive influence on the project economy for the individual part in the building project. It shows that the Danish building sector is aware of the problems with cooperation, and they know that the problems must be addressed in future, hopefully with an economic benefit as result (Faber Ussing, 2010).

Matching of expectations is also important in the respondents' opinion. A good matching of expectations between the parties in a building project can improve cooperation, but the respondents are not very good at doing it themselves. The results show the biggest match of expectations between the owner and the advisers, a lower match of expectations between the advisers and the operating companies and the lowest match between the suppliers and all the others.

The tendering legislation has changed in Denmark, so since 2001 all public building projects are now assign to either the Tendering Rules in EU or the Danish Tender Law (looks like the Tendering Rules in EU). (Ussing, 2008) A lot of Danes find the Tendering Rules in EU very bureaucratic (Faber Ussing, 2010), compared to how the Danes normally act; therefore the respondents were asked if they find that the procurement rules have a negative influence on cooperation on a building project. The respondents find that the rules have a negative influence, but they also find that changes in the rules can have a positive influence on cooperation. Most of the respondents still use the assignment criterion lowest price, so instead of changing the rules, we could start by changing the assignment criteria from lowest price to the economically most advantageous bid, and use assignment criteria as good cooperating and trust to obtain a better cooperation with an economic benefit as result.

The respondents think that trust is important between the parties in the building project to obtain good cooperation. They also find that the trust in the building sector can be improved. Now the trust is highest between people who work closest together. It seems as if the trust is lowest between the parties in the construction phase. Therefore the contractors and the suppliers have something to work on. Even if they just have a bad reputation or there is a real problem; the other parties certainly think that the contractors and suppliers are not as upright and trustworthy as others can wish (Wandahl, Bejder et al., 2011).

Reciprocal understanding and respect goes hand in hand with trust. Therefore the results on that topic are not surprising. The respondents find that on high reciprocal understanding and respect are important to obtain good cooperation on a building project. But something which surprises is that even the respondents find a high reciprocal understanding and respect important, they do not have it in practice. As with the trust the other parties it means, that the contractors and suppliers have a low reciprocal un-

derstanding and respect of others' work. For the other parties the number in the survey is higher but not high enough to conclude that there is no problem.

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THE IMPACT OF CONTRACTORS' TECHNICAL CAPABILITY ON COST AND TIME PERFORMANCE OF BUILDING PROJECTS IN NIGERIA

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ABSTRACT

Technical capability is one of the major criteria for evaluating construction contractors during prequalification and tender evaluation. This paper investigates the impact of contractors' technical capability as a prequalification criterion on cost and time performance of selected building projects. Prequalification assessments on technical capability of wining contractors as well as cost data relating to 77 completed building projects were obtained. The data were analyzed using One-way analysis of variance (ANOVA) and multiple regression. The resulting p-values are 0.937 and 0.011 for cost and time performance respectively indicating that contractors' technical capability has significant impact on time performance while it has no significant impact on cost performance of building projects. Models capable of predicting the final cost and duration of building projects were eventually derived with R^2 value of 96.2% and 90.01% for cost and time respectively; thus signifying high predictive efficacy of the models. The result of the research would therefore for a good basis for predicting realistic cost and time for building projects; while also enhancing objective assessment of candidate contractors during prequalification and tender evaluation.

Keywords: Cost, Impact, Technical Capability, Performance, Time, ANOVA.

INTRODUCTION

The construction industry is a very unique industry when compared with other industries and it is one of the largest industries in most developed economies (Odeyinka, 2003). The structure of the industry is also complex in that it has a wide range of types of contractors comprising main and sub-contractors; low technology firms and sophisticated specialists, builders and civil engineers; and a whole range of professionals connected with the industry (Hillebrandt, 1985). The construction industry also has some distinct characteristics which separate it from all other industries. This according to Harvey and

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Ashworth (1993) includes the physical and investment nature of the product and the arrangement of the industry where design has normally been separated from construction.

Construction projects are one-off endeavors with many unique features such as long period, complicated process, abominable environment, financial intensity and dynamic organizational structures which also generate technological complexity (Zou, Zhang & Wong, 2007). Considering the complex nature of the construction process, contractor performance is significant to the success of any construction project because it is the contractor who converts designs into practical reality (Xiano & Proverbs, 2003). This therefore calls for a sound technical competence of construction contractors to withstand the challenges associated with variable construction activities as well as project performance objectives of time, cost and quality. Contractors engaged in construction business should therefore possess cognate technical capability in terms of equipment and personnel for the execution of any construction project that may be committed to their hand.

Therefore, the construction clients' decision most impacting the superlative value criteria is that of selecting the appropriate contractor (Holt, 1998). The most commonly used criteria for contractors' selection according to Hatush and Skitmore (1997) are those pertaining to financial soundness, technical capability, management capability, health and safety performance, and past performance of contractors. Out of these criteria, contractors' technical capability is one of the most important criteria always considered critical to achieving required quality of projects. Thus any contractor that lacks adequate technical personnel or technical know-how is likened to a vehicle without engine**.** The Bureau of public procurement in Nigeria mandated it for government agencies and parastatals seeking to procure construction projects to ensure prequalification of contractors prior to contract award.

However it has been observed that prequalification assessment of contractors often confirms that prequalified contractors have great potentials to perform if awarded the contract. Despite this, there has been no commensurate improvement in the success rate of construction projects in terms of quality, time and cost. Considering the foregoing therefore a system of predicting cost and time performance of construction projects based on prequalification performance of contractors on technical capability would be worthwhile. This is will assist prequalification assessors/construction practitioners to carry out objective assessment of contractors during prequalification which will in turn assist clients to consider the most viable contractor for contract award in.

LITERATURE REVIEW

The technical capability of contractors is the ability of contractors to employ relevant skills and expertise in terms of technical know-how and equipment capacity to project management with the objective of ensuring project delivery to the desired quality specification within the budgeted cost and time schedule (Aje, 2008). It generally relates to contractors' experience, plant and equipment capacity, the volume and quality of personnel and their general ability. Experience gives insight to the contractors' potential by determining the ability of contractors to commit adequate resources to a large project.

Three things relevant to this variable according to Holt *et. al.* (1994) includes a firm's structure (national or local), the extent of catchments and the firm's mobility potential. A national company will have greater geographical experience which may have been achieved through a network of regional offices. Therefore a national company has wider catchments and hence greater ability to tackle certain types of contract e.g. maintenance contract for a client with properties nationwide.

Furthermore, the suitability of plant and equipment are vital to construction success (Wong & Holt, 2003). Mustapha and Ruan (1990) opined that the availability and suitability of plant can affect the decision of construction clients in selecting a contractor. Staff quality and their experience are also crucial to successful project outcome because the quality of supervisory personnel assigned to a contract reflects heavily on the total efficiency of a contractor's efforts (Holt *et. al.,* 1994). For example a manager who has spent over 25 years trained with and come through the ranks with one particular company is desirable because this facilitates interdepartmental training and a greater familiarity of the company organizational structure (Harris and McCaffer, 1995). Scoring of these criteria is achieved by observing what percentage of the contractor's senior management meet these criteria.

The award of contract to a competent contracting organization should therefore ensure effective delivery of construction project to time, cost and quality standard. Chua *et al* (1999) asserted that it is generally accepted that the major goals in any construction project are budget, schedule and quality. Corroborating this view, Russell *et. al.* (1997) opined that the overall success of a construction project includes meeting goals related to cost, schedule and quality. Therefore the objective of taking all the required precautions and "due process" in the selection of contractor for construction project execution is to ensure performance of the project in relation to the above mentioned variables. Chua *et. al.* (1999) identified proper contractual arrangements as one of the important success factors for construction projects. This implies that the engagement of contractors with track record of technical and managerial capability should enable clients and the project team members achieve the objectives set for the project. Cheung *et. al.* (2004) also noted that selecting a competent contractor is paramount to successful delivery of construction project. Therefore the competence of any contractor in terms of its technical capability, experience and managerial ability reflects heavily on the performance of the project. Unfortunately in Nigeria, in spite of the compulsory prequalification of contractors prescribed by the bureau of public procurement, quality of construction projects has remained unsatisfactory while projects are completed beyond the scheduled time with its attendant cost overrun. This has begin to generate questions from members of the public and stakeholders within the construction industry whether the prequalification exercise really has effect on the performance of the projects or whether the evaluation of the contractors during prequalification exercise is being carried out objectively. It is now expedient on the part of stakeholders in the Nigerian construction industry to ensure that mediocre are weeded out of the Nigerian construction industry. This will enable the government and the private sector client to have value for their huge investment in construction activities.

RESEARCH METHOD

The research area comprised two major Nigerian cities: Abuja and Lagos. These cities were selected because majority of construction practitioners, clients and contractors have their operation office in these two cities. More importantly, Abuja is the seat of government where a lot of development in terms of construction is going on while most of the policy makers also reside there. Due to quantitative nature of this study and bearing in mind the study objectives, data for the study were sourced through a combination of opinion-based questionnaire survey for primary data and from archival materials for secondary data. The preliminary section of the questionnaire was on background information about the respondents. These were required to assist in classifying the firm's size and the experience of the respondents while other sections address the main issues of the study. The prequalification criteria derived from the literature as potential criteria used for contractors' prequalification were also listed. Respondents were then requested to score their opinions on a 0-5 likert type scale, zero being included so as to accommodate the instances where the criterion was not applicable (Holt, 1997). Archival data relating to prequalification assessment of contractors on technical capability, initial contract sum, planned contract duration, completion cost and actual contract duration of completed building projects were also sourced from consultant Quantity Surveyors.

The target population for the study comprised core building professionals involved in the procurement of building projects. These include Architects, Structural Engineers, Quantity Surveyors, Builders and Services Engineers. In order to have an accurate sampling frame, the lists of all professionals who are financial members of their respective professional institutions and based in the study area were used. Data relating to contractors were also sourced from the list of contractors accredited by the Nigerian Institute of Building (NIOB) as published in the register of contractors (2003). In all a sampling frame of 1,355 was gotten representing the total population of the study.

Based on this, the sample size was calculated from the following formula as used by Shash and Abdul-hadi (1992)

$$n = \frac{n^l}{1 + \frac{n^l}{N}}$$

Where n = sample size: $n^l = \frac{S^2}{V^2}$

N = Total population, V = Standard error of sampling distribution = 0.05,
S = the maximum standard deviation in the population elements, P = the proportion of population elements that belong to the defined class

From the above formula, the sample size for the various categories of respondents was therefore found to be 427.

Having defined the study population, the research adopted random sampling technique. A total of 194 questionnaire were collected out of 427 questionnaire distributed while archival data on 77 completed projects were also sourced directly from the consultant Quantity Surveyors. The response rate represents 45.43% of the sample size which is far

above the norm of 20-30% response rate in questionnaire survey of the construction industry (Akintoye and Fitzgerald, 2000).

Prior to data collection, pilot study was carried out using the initial draft of the questionnaire to ensure that the research instrument will establish the most productive form of data analysis. This was achieved by administering the draft questionnaire to 10 selected Subject Matter Experts (SMEs) from the academics and the private practice. The content validity of the research instrument was therefore tested using the content validity ratio developed by Lawshe (1975) as follows:

$$CVR = \left(n_e - \frac{N}{2}\right) \Big/ \frac{N}{2}$$

Where:
CVR = Content Validity Ratio
n_e = number of SMEs indicating that an item is essential
N = total number of SMEs

For the content of a research instrument to be valid the CVR must ranged from 0.99 - 0.51 for 5 to 14 SMEs (Lawshe, 1975). The average content validity ratio calculated is 0.86 indicating that the content of the research instrument used for this study is valid. Reliability test was also conducted on the research instruments using Cronbach's alpha (α). According to Nurosis (1992) a figure of α near to 1 shows higher reliability. The reliability coefficients for the instrument relating to variables of contractors' technical capability and the archival data were found to be 0.772 and 0.959 respectively. This signifies that the instruments used for the study were reliable. The aspects of the questionnaire relating to background information of respondents were analyzed using percentiles. Secondly, the evaluation of the main criteria for contractors' prequalification was carried out using mean score while Analysis of Variance (ANOVA) was used in determining the impact of contractors' technical capability on cost and time performance of building projects. Moreover, the relationship between contractors' technical capability and construction project performance was established with the aid of linear regression.

RESULTS AND DISCUSSION

Background Information of Respondents

Table 1 shows the summary of the background information about the respondents. It is observed from the Table that 35.6% of the respondents have postgraduate qualifications while about 64.4% have minimum of Higher National Diploma in their various fields of study. Furthermore about 9.8% of the respondents are Fellow members of their respective professional bodies, 71.1% and 19.1% of them are also Corporate and Graduate members of their professional bodies respectively. Moreover, the respondents have an average of about 17 years experience in the construction industry and have also participated in at least 11 prequalification exercises within the last three years. This analysis therefore suggests that the data provided by the respondents can be relied upon for the purposes of analysis.

Table 1: Summary of Background Information of Respondents

Category	Classification	Frequency	Percentage (%)
Academic Qualification	HND	27	13.9
	B.Sc/B.Tech	98	50.5
	PGD	13	6.7
	M.Sc/M.Tech	56	29.9
Professional Qualification	Graduate Member	37	19.1
	Corporate Member	138	71.1
	Fellow	19	9.8
Construction Experience (In years)	1 – 10	43	22.2
	11 – 20	85	43.8
	21 – 30	51	26.3
	31 – 40	15	7.7
	Mean	**17.46**	
No. of Prequalification over the last 3 years	1 – 5	48	24.7
	6 – 10	61	31.4
	11 – 15	29	20.1
	16 – 20	24	12.4
	21 – 25	13	6.8
	Over 25	9	4.6
	Mean	**10.94**	
Total value of projects executed in the last financial year	₦1m – ₦50m	82	42.3
	₦51m – ₦100m	41	21.1
	₦101m – ₦500m	31	16.0
	₦501m – ₦1Billion	31	16.0
	Over ₦1Billion	9	4.6

Table 2: Respondents' Ranking of the variables of Contractor's Technical Capability

Criteria	Clients		Consultants		Contractors		Overall		F-Stat	Level of sig. (p-value)
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank		
Contractor's experience and ability	4.57	1	4.74	1	4.43	1	4.65	1	3.886	0.022**
Plants and Equipment	4.00	4	4.57	2	4.17	2	4.40	2	12.213	0.000*
Level of Technology	4.11	2	4.55	3	3.98	4	4.36	3	9.167	0.000*
Workmanship Quality	4.07	3	4.46	4	4.07	3	4.32	4	5.071	0.007*

*** Significant at p<0.01**
**** Significant at p < 0.05**

Variables of Contractor's Technical Capability

From Table 2 respondents were of the view that contractors' technical experience and ability is of utmost importance when evaluating contractors' technical capability during prequalification exercise. This without doubt, will influence the technical performance of the contractor in the proposed project. The number and quality of plant and equipment possessed by the firm was surprisingly rated higher than the quality of workmanship. This may be as a result of the fact that the ability of workmen to work judiciously to produce quality product depends on the conditions of plants and equipment while the success of construction works in terms of meeting schedules and ultimately achieving optimum cost performance depends on the type and capacity of equipment used. Even though majority of contractors in Nigeria except the few ones who are well established does not have most of the basic equipment and construction plants needed for

construction works. Rather they depends on plant hire which are not usually indicated in the documents submitted for prequalification, this may have also influenced the subjective assessment of plants and equipment under contractors' technical capability.

Furthermore, the fact that majority of the contractors depend on equipment hire, as against the number of equipments they claimed to own may have being one of the major reason why their technical performance on site does not usually match their ratings on technical capability during prequalification evaluation. The ratings of clients on plants and equipment also confirm that the clients are aware of the fact that most construction contractors usually depends on plant hire. The p-values generally show that there is no agreement among the respondents in the ranking of the variables of technical capability. However, because of the government legislative protection of local or indigenous technology as specified under the local content emphasis, level of technology was not ranked high as compared with contractors' experience and quality of equipments. This may also be the reason why contractors ranked level of technology least in their ranking. The idea according to most contractors interviewed is that level of technology is insignificant if quality and time schedule can be met, they further confirm that Nigerian contractors are gradually improving on their level of technology.

Impact of Contractor's Technical Capability on Construction Project Performance

Tables 3 and 4 show the results of the one way analysis of variance of the impact of contractors' technical capability on cost and time performance of construction projects. From Table 3 the observed value of F is 0.066 and p-value is 0.937. In Table 4, the F-value as observed is 4.808 and the p-value is 0.011. The result shows that the technical capability of contractors has no significant impact on cost performance of construction project since the p-value is greater than 0.05 (p-value = 0.937). On the other hand, the p-values of 0.011 observed in Table 4 is less than 0.05 at 95% confidence level signifying that the Contractors' Technical Capability has significant impact on time performance of construction project.

Table 3: One-way Analysis of Variance on the Impact of Contractors' Technical Capability on Cost Performance

Source	DF	SS	MS	F-ratio	Sig. (p-value)	Remarks
Between Groups	2	8.040	4.020	0.066	0.937	NS.
Within Groups	74	4534.485	61.277			
Total	76	4542.525				

NS = Not Significant

Table 4: One-way Analysis of Variance on the Impact of contractors' Technical Capability on Time Performance

Source	DF	SS	MS	F-ratio	Sig. (p-value)	Remarks
Between Groups	2	3868.29	1934.145	4.808	0.011*	S
Within Groups	74	29769.559	402.291			
Total	76	33637.85				

***Significant at p < 0.05**

The significant impact of contractors' technical capability on time performance may be as a result of the fact that contractors' experience and ability as well as quality of plant and equipment are considered important to technical capability as can be seen in Table 4,

which according to Mustapha and Ruan (1990) are crucial to successful project outcome. Generally, the technical capability of contractors in terms of quality of plants and equipment, the contractors' experience and ability has direct relationship with construction project time performance. This is because the availability of plants and equipment has direct effect on contractors' progress on site while at the same time improving the morale of the technical staff to ensure that there is general progress on site, which in turn bears on the techniques of executing the job to achieve quality product resulting to high productivity.

The Relationship between Contractors' Technical Capability and Performance of Construction Projects

A major objective of this study was to determine the relationship between contractors' technical capability and performance of construction projects in terms of cost and time. Such relationship would assist construction clients' and practitioners in determining how this criterion is likely to affect project objectives in terms of cost and time prior to contract award. This will benefit contractors by helping to eliminate incompetent contractors and thus creating fairer competition among contractors. Therefore, data on initial contract sum, completion cost, planned contract duration and the actual contract duration as well as prequalification assessment of contractors on technical capability sourced from consultant Quantity Surveyors were employed. The technical capability of contractors was assessed jointly by a team of consultants and the client during prequalification evaluation based on the prequalification documents submitted by the contractors. The information provided by the contractors were subsequently confirmed by inspecting past projects executed by the contractors and a visit to their various offices. Information from the clients who have worked with the contractors in the past were used to substantiate the claims of the contractors. This technical capability in respect of each contractor was rated on a point scale of 20 as prescribed by the bureau of public procurement and was later transposed to 100 percent by multiplying the scores of each contractor by 5. Therefore the relationship between contractors' technical capability and completion cost is thus presented as:

$$Pcc = -22599787.9 + 1326027.04Tc + 0.987Ics + 15318.82Pcd + e \quad \text{..... (i)}$$

($R = 0.981$, $R^2 = 96.2\%$, Adjusted $R^2 = 95.9\%$)

Where,
Pcc = Project completion cost,
Tc = Technical capability
Ics = Initial contract sum
Pcd = Planned contract duration, and
E = Error term

A widely used measure for the predictive efficacy of a model is its coefficient of determination, or R^2 value which according to Xiano and Proverbs (2005) measures the strength of the linear association between two or more variables. If there is a perfect relationship between the dependent and independent variables, R^2 is 1. In case of no relationship between the dependent and independent variables, R^2 is 0. The predictive efficacy of the cost performance model was found to be very high with an R^2 value of 0.962 and adjusted R^2 of 0.959. This result indicates that the project completion cost is

positively related to contractors' technical capability at the level of significance of 0.0001. Moreover the *F* statistic of a model basically tests how well the model, as a whole accounts for the dependent variable's behaviour. However, the constant estimate for this model is not significant (p = 0.349) signifying that the constant value do not significantly contribute to the model. The *F*-value of this particular model was found to be statistically significant at less than the 0.0001 level. The regression analysis results are summarized in Tables 5 and 6.

Table 5: Result of multiple regression analysis of the cost performance prediction model

R	R^2	Adjusted R^2	Std. error of est.	F	Sig.
0.981	0.962	0.959	19249569.35	487.910	0.000

Predictors: (Constant), Technical Capability, Initial Contract Sum, Planned Contract Duration.

Table 6: **Coefficients in the Model**

Variables in the Equation	β	Std. Error	Beta	t-stat.	Sig.
Constant	- 22599787.87	2.3×10^8		-0.943	0.349
Technical Capability	1326027.04	1.4×10^7	-0.002	0.935	0.003
Initial Contract Sum	0.987	0.031	0.977	2.026	0.000
Planned Contract Duration	15318.82	19794.09	0.020	0.773	0.002

Moreover, the regression equation for the final contract duration from which the project time performance can be determined is stated as:

$Acd = -27.682 + 4.267Tc + 1.79 \times 10^{-7} Ics + 1.008Pcd + e$…….2

($R = .949$, $R^2 = 90.1\%$, Adjusted $R^2 = 89.6\%$)

Where,

Acd = Actual contract duration
Tc = Technical capability
Ics = Initial contract sum
Pcd = Planned contract duration, and
E = Error term

The predictive efficacy of the model as defined by the R^2 value is 0.901 while the adjusted R^2 is 0.896. The *F*-value of the model was also found to be statistically significant at less than the 0.00001 level indicating a high degree of fitness of this model. Also the p – value of the constant estimate of 0.686 implies that the constant value do not contribute significantly to the model. Tables 7 and 8 summarize the result of the regression analysis.

Table 7: Result of multiple regression analysis of the time performance prediction model

R	R^2	Adjusted R^2	Std. error of est.	F	Sig.
0.949	0.901	0.896	1.58×10^5	175.668	0.000[a]

Predictors: Constant, Technical capability (Tc), Initial contract sum (Ics), Planned Contract duration (Pcd).

Table 8: **Coefficients in the Model**

Variables in the Equation	β	Std. Error	Beta	t-stat.	Sig.
Constant	27.681	68.106		-0.157	0.686
Technical Capability	4.267	4.031	0.046	0.822	0.002
Initial Contract Sum	1.79×10^{-7}	8.83×10^{-8}	0.098	2.398	0.001
Planned Contract Duration	1.007	0.056	0.903	18.608	0.000

Model Validation

Tables 9 and 10 show the results of the regression test on the cost and time performance models respectively. In Table 9, the coefficient of determination as defined by the R^2 value is 0.995 while the intercept and the slope are - 2.61 x 10^{-7} and 1.00 respectively.

Table 9: Regression result between the observed and the predicted cost

R	R^2	Adjusted R^2	Intercept	Slope	Sig.
0.997[a]	0.995	0.994	-2.41 x 10^{-7}	1.00	Not Sig.

Table 10: Regression result between the observed and the predicted duration

R	R^2	Adjusted R^2	Intercept	Slope	Sig.
0.904[a]	0.818	0.804	-9.73 x 10^{-5}	1.03	Not Sig.

Also in Table 10, the R^2 value is 0.818, the intercept is -9.73 x 10^{-12} and the slope is 1.03. It then follows that there is no significant difference between the observed and predicted values of the cost and time performance models. Therefore the models developed in this study can accurately predict cost and time performance of construction projects since the result of the regression test carried out agree with Ogunsemi and Jagboro (2006).

CONCLUSION

This study has clearly shown that contractors' technical capability is an important criterion for evaluating potential performance of construction contractors during prequalification and tender evaluation. Also the study identified past performance and quality achieved, contractors' experience, management knowledge and quality control programme as the major variables for evaluating contractors' technical capability. The study further revealed that contractors' technical capability has significant impact on cost and time performance with a p-value of 0.042 and 0.039 respectively. This therefore corroborates the reason why technical capability was considered important among the important criteria for contractors' prequalification in Nigeria. The study also shows that construction project cost and time performance is correlated with contractors' technical capability. Based on this, predictive models for project completion cost and actual contract duration of building projects was established and validated. This will enable consultants and clients determine the cost and time performance of construction projects based on prequalification assessment of contractors on technical capability, the contract duration and tender figure quoted. This therefore implies that it is possible to forecast the actual contract period and completion cost of projects right from the onset based on the aforementioned variables. This will therefore provide early sign of contractors' likelihood performance to clients and consultants before the final award decision. It is believed that the practical application of these models will significantly enhance their improvement thereby ensuring the selection of the most competent contractors for construction projects.

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THE IMPACT OF PROCUREMENT SYSTEMS ON THE OUTCOMES OF PUBLIC PROJECTS: THE CASE OF MALAWI

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ABSTRACT

Government of Malawi is concerned with the rate of failure of public construction projects in the past ten years. Successful execution of construction projects depends on procurement methodology. Therefore, this study aims at investigating the processes and factors considered when conducting the procurement of public construction projects in Malawi. It also measures readiness of the procurement practitioners in particular organisations to change the procurement systems. Analysis of quantitative survey data reveals that there is significant consistency across public sector agencies in the nature of procurement practice. Although the analysis did not prove that the donor procurement rules and adherence to traditional procurement were inducement to project failure, respondents unanimously denounced donor procurement guidelines; instead they advocate for launching of concurrent engineering system of procurement. The study confirmed that the failure rate of construction projects stood at approximately 40%. Based on the findings, the study proposes that the procurement legislation should be reviewed to allow for flexibility on the approach to construction procurement.

Keywords: integrative, Malawi, performance, procurement, public.

INTRODUCTION

Selecting the most appropriate organisation for design and construction work represents a fundamental aspect of the modern construction procurement process (Turner, 1997: 327; Ashworth, 2002: 53). Increasingly, the integrated client team includes facilities management practitioners (particularly those concerned with client strategic issues in the organisation) who need to be familiar with the expanding range of procurement options now on offer (Masterman, 2002: 8). Within this process, many researchers agree that "design", "management" and "construction" can theoretically be viewed as discrete parts, although in reality some synergy and overlap does exist (Best and de Valence, 1999: 72;

Walker and Hampson, 2003: 97). For this reason, categories of procurement methods have been classified around three distinct activities:

- Traditional systems (including cost-plus, provisional quantities);
- Design and build systems (including design, management and construction, and novation);
- Management-oriented systems (including design and manage, management contracting and construction management).Selecting an appropriate procurement path is a complex and daunting task for both the client and the client's advisers and remains an enigma for many researchers, as evidenced by the volume of research conducted in this subject area (Franks, 1984: 113; Bennett and Grice, 1990: 20; Chan, Scott and Lam, 2001; Cheung, Lam, Leung and Wan, 2001; Masterman, 2002: 54). It is often recommended that the choice of procurement route should be based on the client's objectives and priorities (Turner, 1997: 329) as well as engineering, economic, environmental and social considerations (Love, 1996: 329). The most common criteria found in literature concerning the choice of procurement methods include time, certainty, flexibility, quality, complexity, risk, price competition, responsibility, and dispute and arbitration (NEDO, 1985: 20; Skitmore and Marsden, 1998: 71; Love Skitmore and Earl, 1998: 1). Notably, research on procurement selection has tended to focus on Western construction industries with limited research being undertaken in developing countries (Love et al., 1998: 5). The Malawian construction industry currently has an infamous reputation for being inefficient and lacking in effectiveness (National Construction Industry Council, 2010: 23) as evidenced from the results of this research. In response to this the paper uncovers facts about processes leading to such failures.

Objectives of the paper

The rate of failure of construction project may be an indication of weak configuration in the way the projects are managed from conception to close out. The interest of this paper is the conception phase of the project (procurement planning) with the objective of investigating the procurement practices and possible impacts on the outcomes in terms of client satisfaction criteria. Increasing the achievement of these criteria has been associated with the method of procurement (Love, Skitmore and Earl, 1997: 221). To this end, the variables investigated include: cost, time, risk allocation, quality, complexity and uniqueness of a project. It also investigates the procurement experts' inclinations in considering organisational setups (culture, stakeholder involvement, value for money etc) when selecting a method of procuring construction projects. The associated research questions are:

- What percentage of public construction contracts fail to be delivered successfully?
- Do the procurement practitioners perceive that project sponsor's (debt/grant financing) procurement methods contribute to the mundane performance of the public projects?
- Do practitioners believe that there is a relationship between the integrative approach to procurement (stakeholder involvement) and the outcomes of public projects delivery?
- What are the factors influencing the choice of procurement assessment criteria in Malawi?

- What is the altitude of public procurement specialists towards departure from the inherent traditional procurement to integrate concurrent engineering system of procurement in Malawi?

The paper further interests the respondents to state their level of willingness to adopt other methods of public procurement thereby insinuating change to the Procurement Law of Malawi.

CONCEPTUAL FRAMEWORK AND POLICY CONTEXT

The design and construction of buildings must attain a compromise in the circumstances existing at the time of conception between product, programme and price (quality, time and cost) (Ashworth, 2002: 57; Walker, 2002: 28). Client and project characteristics, as

well as the individual project requirements, are strongly related to procurement method selection. The National Economic Development Office (NEDO) (1985: 25) has set down probably the most important procurement assessment criteria (PAC) to guide assessment of client's priorities. In fact, the nine criteria identified by NEDO can be regarded as the most important framework used for assessing client's priorities and has been employed directly or indirectly by many researchers (Skitmore and Marsden, 1998:71), Turner (1997: 328), Love et al, (1998: 3), Cheung et al, (2001: 427), Chan et al, (2001:710) and Chang and Ive, (2002: 276). Although previous studies did not use identical PAC, it is clear that a consensus of opinion suggests that the most suitable PAC does exist among the researchers (Chang et al, 2002: 275). Table 1 contains the most commonly used project criteria with the early work by NEDO providing nine of these; speed (time), price certainty, flexibility, quality level, complexity, risk avoidance, price competition, responsibility, and dispute and arbitration (National Construction Industry Council, 2010: 25).

Res **Table 1: Procurement Assessment Criteria**
(Source: adapted from Cheung et al. 2001)

Procurement assessment criteria	Franks (1984)	NEDO (1985)	Skitmore & Marsden (1998)	NEDO (1988)	Bennett & Grice (1990)	Materman & Gameson (1994)	Love *et al.* (1998)	Cheung *et al.* (2001)	Chan *et al.* (2001)
Speed/Time	●	●	●	●	●		●	●	●
Uncertainty		●	●	●	●	●	●	●	●
Risk of changes		●	●		●	●	●	●	●
Quality level	●	●			●		●	●	●
Complexity	●	●	●		●		●	●	●
Risk avoidance		●	●	●	●		●	●	●
Tight budget	●	●	●		●	●	●	●	●
Uniqueness of project		●	●	●			●	●	●
Dispute and arbitration		●		●			●		
Accountability					●	●			
Innovative advice from consultants									
Value for money				●	●	●			

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RESEARCH DESIGN AND METHODOLOGY

The main research method is quantitative. The research was conducted using the practitioners from client organisations as research subjects. However, analysis of the results required interpretive and deductive reasoning more akin to qualitative approach. The selected organisations were primarily responsible for procurement methods selection in the delivery of public sector projects such as housing, water, buildings, power and roads. The main research strategy employed is the evaluation study with theory building connection using deductive reasoning. In order to obtain a comprehensive view of procurement practices across the Malawi's public sector, the survey instrument was emailed to lead procurement staff in organisations who conduct heavy construction across the public sector. The respondents were identified by what can be described as an opportunist sampling. That is, the office of the director of public procurement (ODPP) identified a number of stakeholders from their own experience in Malawi (since there are no formal records of public sector organisations which typically deal with construction

and its procurement). Staff contacted came form the following public departments the ODPP, procurement staff of the Roads Authority, the Procurement Specialists from the Malawi Regulatory Authority, the Malawi Housing Corporation, Ministry of Irrigation and Water development, Blantyre Water Board, Central Region Water Board, Northern Region Water Board, Southern Region Water Board, the Ministry of Education, Ministry of Agriculture and ESCOM. Twenty one percent of the selected practitioners spend more than MK1 billion (US$6 million) per year. The persons that were selected to complete a structured questionnaire were primarily responsible for procuring and delivering public sector construction projects such as housing, roads, water supply and power.

The questionnaire elicited views on general experience, knowledge, opinions, viewpoints and willingness to adopt other methods. A total of 40 survey questionnaires were distributed to key stakeholders within the industry including 2 respondents who tested the survey in a pilot study, and a total of 26 survey questionnaires where received back.

Respondents were requested to assess each criterion on a Likert scale of 1 to 5. The five-point scale was transformed into relative importance indices for factors in some of the research questions, using the above method, to determine the ranks of the different factors. These rankings made it possible to cross-compare the relative importance of the factors as perceived by the respondents. Hypotheses were also tested to validate or invalidate earlier assumptions. Areas covered include the research design, population, data collection and analysis and plan of activities.

Limitations and assumptions of the study

- The analysis is exclusively on the procurement of construction contracts in the public sector;
- The analysis will focus on construction procurement and project performance areas only;
- The time frame for the study spans from 2003 to 2011;
- The number of respondents can be viewed as a limitation but it should be kept in mind that the construction industry in Malawi is relatively small and limited numbers of people participate in public construction procurement.
- Procurement is a new field in Malawi and not much has been published.

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FINDINGS AND DATA ANALYSIS

Content analysis was used to determine the underlying reasons as to "how and why" the selected public sector agency selected a particular procurement method for its construction projects. The data derived from the questionnaire was entered into SPSS (Statistical Package for the Social Sciences). Five main themes emerged and were used to analyse the data: organisational setup (including culture, project approach vis-à-vis efficiency), procurement selection factors, and influence of donor procurement systems, level of involvement of project stakeholders and donor funded projects' procurement rules and are reported under the subsequent paragraphs. Data from the questionnaire were extracted and the scores of criteria reported on for all respondents (Figure 1 to right and 2 below) as can be seen, out of the nine factors discussed in Section 2 above, the factor with the highest score given by all respondents is time (68%), followed by degree of complexity (67%) and uniqueness of a project (64%), the lowest is risk about the project (62%)

The results of the analysis on obstacles in attaining project triple bottom objectives: respondents have identified four main obstacles with "focus on short term goals topping the list.

The other three (in diminishing significance) are: lack of ethics, project focus and not process focus and lack of stakeholder consultation. With regard to practitioner's opinion of the degree of causation of failure by certain nominate factors, the respondents selected the following in descending order of significance: Poor project communication and information technology and absence of risk management, level of sponsors involvement, and lack of monitoring plan. However, plotting the factors

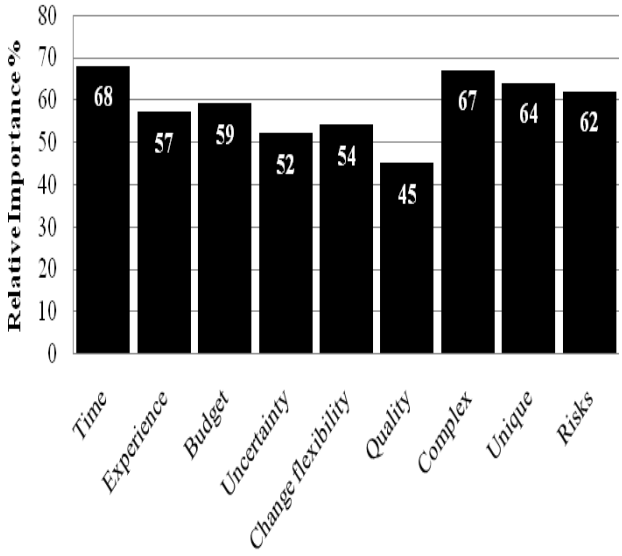

Figure 1 Ranking of Procurement Selection Method Factors by Respondents

indicate that there is no correlation between the factors utilised. However, it has also been shown that practitioners have a high level of willingness to change from traditional procurement to concurrent engineering.

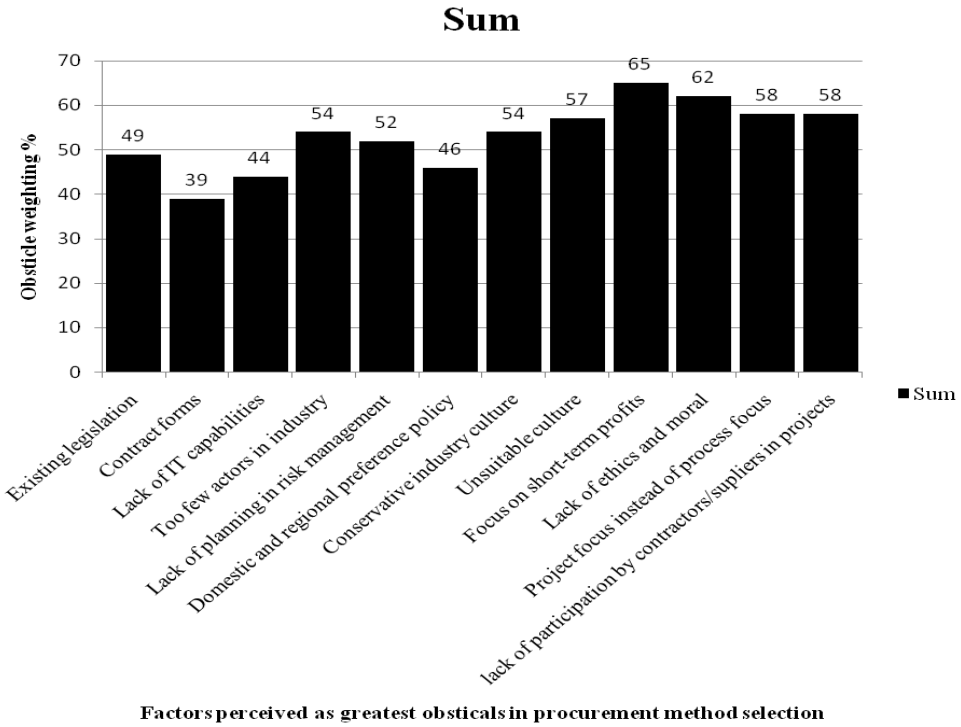

Figure 2: Statistics on Greatest Obstacles to Project Success

It is further demonstrated that procurement practitioners are more familiar with traditional type of procurement refer to Figure 3 below. It can be consummated that not adequate capacity building has taken place to acquaint practitioners to different methods of construction procurement. This has been correlated with the altitude expressed on the degree of familiarity different procurement laws. Most practitioners have indicated allegiance with procurement law of Malawi only (refer to Fig. 4 below). This outlook purports the insignificant level of improvement on the project performance.

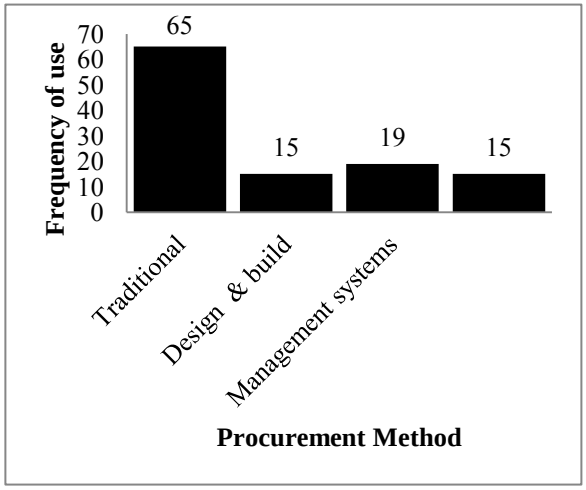

Figure 3: Frequency of Procurement method

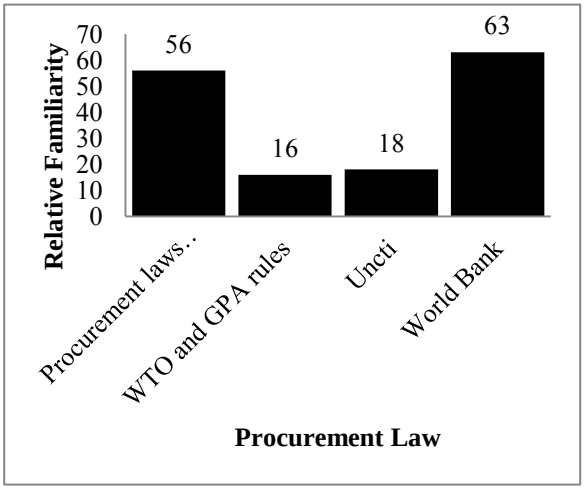

Figure 4: Practitioners' familiarly with procurement law

Hypothesis validation/invalidation

The following were the findings after analysis:

- **Hypothesis No. 1**: That construction time, cost and quality are not significantly affected by organisation setup (culture, lack of project approach and procurers skills).
- **Hypothesis No 2**: That selection factors have an impact on the outcomes of public project. The results under sub hypothesis: "Experience with a procurement method not influencing the project failure" which indicates p value of 0.07 (very close to 0.05), under "Degree of complexity of a project not influencing the project failure" with a p value of 0.029, the sub hypothesis can be rejected. Under "Risk about the project environment not influencing the project failure" with X2 (6) = 15.348 and p value of 0.018 (with 0.05 required) and an r value of 0.4 (moderate correlation), the sub hypotheses can be rejected.
- **Hypothesis No 3**: Procurement guidelines which are brought about by donors

  (sponsors) of construction projects do not significantly affect the project triple bottom project constraints. The results on the null hypothesis are very clear that the null hypothesis can be retained.
- **Hypothesis No.4**: Competition which is advocated by Malawi procurement law rather than cooperation which is now generally globally accepted in the commercial sector as the key to project success significantly affect project

performance. The null hypothesis was rejected i.e. the probability values are ≤ 0.05 and moderate correlations e.g.: Lack of participation by contractors: X2 (6) = 12.507, p = 0.052 = 0.05 (required) and r = 0.4; Lack of information and communication technology capabilities: X2 (12) = 22.351, p = 0.034 ≤ 0.05 and r = 0.5 (required); training of practitioners: X2 (9) = 16.904, p = 0.05 = 0.05 (required) and r = 0.3; lack of information and communication technology capabilities: X2 (12) = 22.351, p = 0.034 ≤ 0.05 and r = 0.5

- **Hypothesis No 5**: That traditional procurement methods being practiced in Malawi and the level of adoption to change do not significantly affect the project performance objectives. This null hypothesis was therefore retained.

CONCLUSIONS AND RECOMMENDATIONS

In terms of weighting of procurement factors, the survey results demonstrate that time, budget, stakeholder involvement were perceived to be of significant importance when selecting a procurement path as they were awarded the highest scores. Complexity, uniqueness and risk follow fourth on the priority list ranked by practitioners. The study deduces that because of the high uncertainty of cost and time associated with construction activities, it is reasonable, logical and convenient for Government to adopt the most familiar type of procurement method for their projects, namely, the traditional procurement approach.

The results also show that the "finished product quality" aspect was not given prominence by a significant number of respondents. This attitude gives further support on why Government has adopted the traditional procurement path that has proved to result in lowest cost contractors being selected almost always. In fact it has been used in Malawi since the colonial era and is likely to remain the preferred choice for the immediate future (Institute of Procurement Managers, Proceedings of Annual Procurement Conference, 2009: 10).

Furthermore the statistical analyses of the responses indicate that the procurement practitioners perceive that they have been adversity affected by the procurement rules by donors. This argument is not validated as to cause project failure. However the basis of the fear needs to be investigated further for all inclusive conclusions to be made. The use of integrative procurement procedures, concerning early involvement of contractors in joint specification (soft parameters) facilitate the establishment of cooperation in client-contractor relationships are supported by the results from the investigation because the results indicate that there is a strong relationship between stakeholder involvement (from the start of a project to completion) to the success thereto. The lack of flexibility in the current procurement law to explore other methods of procurement may have lead to the inherent project failures registered in the last 10 years. With the survey results indicating that the method in procuring works contracts is predominantly traditional (lumpsum), it is clear that lessons need to be drawn especially in connection with the failure rate of construction projects (refer to Fig. 5 below). The analysis indicates that there is consistency with the assumptions (results moderately correlated). There is very strong consensus amongst the practitioners that Malawi needs to change from the status quo and embrace concurrent engineering approach. The case of paradigm shift from the traditional

procurement method to concurrent engineering has been supported by the results of the survey with 42 % of the respondents strongly voting for change to concurrent engineering. The results of hypothesis No. 3 testing have shown that competition which is advocated by the Procurement Law in Malawi is less favoured by the practitioners than the corporation among stakeholders.

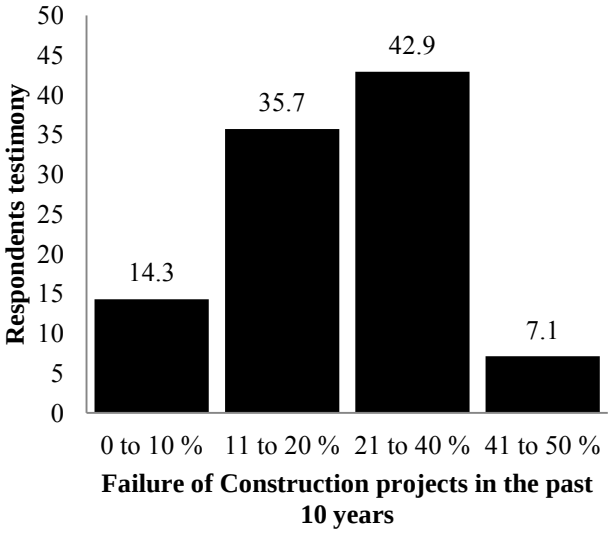

Figure 5: What Percentage of Project have Failed in public organisation in the past 10 years

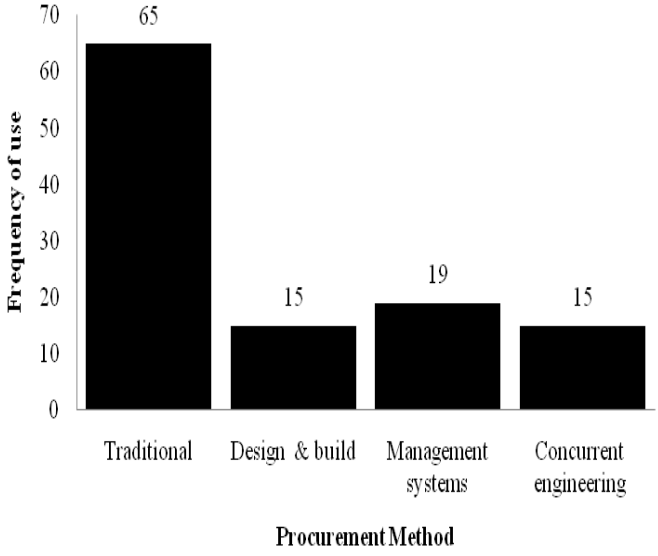

Figure 6: Frequency of Use of Procurement Methods

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TOWARDS HIGH PERFORMANCE THROUGH COMPETITION IN THE CONSTRUCTION INDUSTRY IN JAPAN

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ABSTRACT

The performance of the construction industry in Japan has been high but its price competitiveness has been low. Due to rapid change of the industry environment such as social requirement of fair implementation process of public works, however, there is a deep concern that the performance of the industry is being lowered. Many efforts are being made to keep its high performance through enhancing its competitiveness. Comparison between essences of public bidding reforms in Japan and principles of the Best Value Approach shows some ideas on future of public bidding scheme. They are importance of various levels of feedback loops in social capital management and clarification of the position of supervision for appropriate risk sharing between the public client and the vendor. Additionally, in order for local governments with insufficient engineering resources to be truly accountable, it is worthwhile studying alternative evaluation method of proposal and performance including non-technical one.

Keywords**:** best value approach, comprehensive evaluation method, construction industry performance, Japan, public bidding

INTRODUCTION

Recently, the construction industry in Japan is going through major turning points. It is often said that the performance of the industry has been high but its price competitiveness has been low. Due to rapid change of the industry environment such as social requirement of fair implementation process of public works, however, there is a deep concern that the performance of the industry is being lowered. Many efforts are being made to keep its high performance through enhancing its competitiveness.

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To realize continuous improvement, it is always useful to study and share theory and practice in other countries. Design and operation of public bidding systems is not exceptional. To discuss what should be strengthened in public bidding reform, this paper focuses on the "Best Value Approach," advocated by Kashiwagi (2010) as a reference of theory and practice in other countries. Since this approach incorporates feeling of "site people" and has much similarity to Japanese schemes, it is expected to give a good hint for a reasonable and realistic solution.

The objective of this paper is, thus, to 1) explain characteristics of the conventional public bidding schemes, 2) overview the reform history of public bidding schemes and the comprehensive evaluation method (CEM), which is to appraise price, technical proposal, and past performance of each bidder, 3) compare the Japanese public bidding reforms with the Best Value Approach, and 4) identify possible areas to be strengthened to achieve the high performance through high competition in the construction industry in Japan which are also applicable to other countries.

CONVENTIONAL PUBLIC BIDDING SCHEME

Designation, "Dango," and the Ceiling Price are characterizing factors of the public bidding systems since the period of high economic growth in Japan. The client first designates trustworthy companies. Dango is complementary and rotational bidding. These designated companies discuss and determine the winner for the project. In some cases the client takes the initiative and authorizes the winner.

This scheme has characteristics. First, quality is ensured. Once the extremely poor work is founded by the client, that vendor would never be designated. Second, transaction costs, particularly the contract monitoring costs and contract enforcement costs are considered low (Watanabe, 2007). Thus, the conventional scheme had been contributing much to smooth implementation of many projects with good quality. Since the price competitiveness is low, however, the construction industry in the conventional scheme is classified in Quadrant III in the Construction Industry Model (Kashiwagi, 2010).

This scheme has a more serious problem than the low price competitiveness. Since the amount of public investment started decreasing, many cases are observed in which dango does not work well. In 1993, one governor and two mayors were arrested for bribery in public biddings. Contractors who desperately wanted projects gave bribe to these politicians and ask them to give "the voice from the heaven" to the other bidders so that they would give up competing. Since then, many dando incidents have been reported. In public bidding during downsizing economy, dango becomes much less successful in Japan. It is needed to develop alternative method to dango that all bidders accept the process and the result of the selection.

REFORMS OF PUBLIC BIDDING IN JAPAN

Overview of reforms

The Japanese government has been making reforms of public bidding. The immediate objective was to enhance fairness of the procedure by improving transparency. In 1993, the Central Council on Construction Contracting Business

worked out the proposal named "Reform of the Bidding and Contracting Procedures for Public Works". In this reform, introduction of the general competitive bidding scheme is determined.

As the designated competitive bidding was replacing the general competitive bidding, however, the anxiety or even fear that quality of construction works may not be ensured in future was growing. There was a great risk that the Japanese construction industry would fall down into Quadrant I from Quadrant III. In 2005, thus, "The act for ensuring the quality of public works" was enacted. The act clarifies fundamental principles and responsibilities of the public client of ensuring quality of public works. The act also states replacement of "competition solely through price" with "comprehensively superior procurement based on price and quality." Here the CEM becomes a key component to procure good quality service with fair and competitive procedure.

Other key components

In addition to the CEM, other key components are refined and developed. The project performance evaluation and CORINS are representative components.

Table 1 shows a prototype of project performance evaluation sheet used by the MLIT. Scores associated with evaluation of "d" and "e" are very low. These high negative scores become important factors preventing execution of extremely poor works.

Table 1: A Prototype of Project Performance Evaluation Sheet

Inspection item		Chief technical evaluation officer					Overall technical evaluation officer					Technical inspector				
Item	Sub Item	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
1.Organiza-tion	I. General		1.5	0	-5.0	-10										
	II. Project Engineer	3.0	1.5	0	-5.0	-10										
2.Construct-ion situation	I. Constr. control		1.5	0	-5.0	-10						5	2.5	0	-7.5	-15
	II. Delivery control	1.0	0.5	0	-5.0	-10	10	5	0	-7.5	-15					
	III. Safety management	2.0	1.0	0	-5.0	-10	15	7.5	0	-7.5	-15					
	IV. Public relations	2.0	1.0	0	-2.5	-5										
3.Completed part and workman-ship	I. Completed part	2.0	1.0	0	-2.5	-5						10	5.0	0	-10	-20
	II. Quality	2.0	1.0	0	-2.5	-5						15	7.5	0	-12.5	-25
	III.Work-manship											5	2.5	0	-5	
4. Advanced technology	I. Advanced technology	(13)		0												
5.Originality & ingenuity	I. Originality & ingenuity	(7)		0												
6. Sociality	I. Regional Contribution						10	5	0							
SUM (=1+2+3+4+5+6)																
Total score (=65+SUM)																

The other component is CORINS (Construction Records Information System) developed by the JACIC (Japan Association of Construction Information Center). This puts the construction record of the public works which contractors register as

"construction records" into the database, and provides it with public organizations. Registration of the public works was started in March, 1994 for those contracts of more than 50 million JPY and was extended to more than 5 million JPY in fiscal year (FY) 2002. As of the end of March, 2010, the number of contractors registered is about 131,000 in total and the number of registered completion construction projects is approximately 3,188,000 in total. This database has been in great use.

INTRODUCTION OF THE CEM

Brief History of the CEM

The CEM has been continuously revised based on results of careful monitoring (Ozawa 2012). Social environment of the CEM is changing. Vendors' strategies to the CEM are also changing. Evaluation items and weight associated with each item are changed in a timely manner based on thorough analysis of results of the CEM.

The CEM in Japan was first applied to two public projects ordered by the former Ministry of Construction in FY 1999. The original objectives of the CEM are to utilize the advanced technology of the private sector, improve the value for money of public investment, and increase the social benefits.

Since application of this type of the CEM needs many preparatory works, however, introduction and utilization of the CEM was very much limited. Thus, "The evaluation method of the performance in the CEM regarding the bidding on construction work" was established in 2002. This method sets the ceiling price at the price of a standard construction method, and giving 100 points as the standard points and 10 points as the additional points. This type of the CEM is positioned as "the standard type CEM." With this direction, the work load of preparation for the CEM was greatly reduced.

In "The Act of promoting quality assurance" enacted in 2005, the role of the CEM is changed to ensuring the quality of public works. Thus, it is required to apply the CEM to projects with small room for technical ingenuity that are ordered by the national and local governments. Here, "The Simple Type" was introduced to comprehensively evaluate the price and the technical capability to ensure the quality of a project with a standard method developed by the client. In addition, "The Proposal of the Advanced Technology Type" was also introduced to solicit advanced technologies which may bring necessary changes in the final product. With "The Simple Type," "The Proposal of the Advanced Technology Type," and "The Standard Type," the CEM is possible to apply to any project with each characteristic such as type of work, scale, and requirement conditions, etc. Now the CEM is applied to more than 99% of projects ordered by the MLIT.

From the second half of fiscal year 2005, price competition became very severe. Extremely low bids frequently occur, and concern of quality deterioration due to poor works has further risen. Thus, "On Emergency Measures to Ensure Quality of Public Works" was summarized in December 2006. As the key measure, the further additional points are introduced of evaluating construction systems. This scheme is called "Verifying Construction Systems Type." Furthermore, in FY 2008 when the serious recession visited, it was required to tale economic measures and to make an early execution of the supplementary budget. To deal with this situation,

an even simpler CEM than "The Simple Type" was applied by emphasizing the past performance of each bidder and skipping submission of a concise construction plan and the interview with engineers.

Effects of the CEM

Table 2 shows how much the CEM has been applied to the projects ordered by the MLIT and the average of the project performance score. The average scores steadily increases as the CEM is applied to more projects.

Table 2: Application and effects of the CEM in projects ordered by the MLIT

FY	The number of applied projects	The ratio of applied projects (%)	Average of Project Performance Score
2005	8,146	16.9	73.2
2006	7,996	76.2	73.7
2007	11,248	97.1	74.2
2008	10,068	98.8	75.0
2009	9,300	99.2	75.6
2010	3,879	99.2	75.5

Note: Evaluation method is modified in FY 2010.

To further study the effects of the CEM, questionnaire survey was conducted by the MLIT in between October 18, 2010 and November 12, 2010. Respondents to this survey are 10 Regional Development Bureaus of the MLIT, etc, 66 local governments, 47 Prefectures, 19 ordinance-designated cities, 414 construction companies, and 716 ordinary people through WEB questionnaires. Two main questions are asked: a) what effect has already appeared or is expected to appear in future and b) requests for improvement of the CEM. Since similar surveys were conducted in 2006, comparison is made to the previous survey. Summary of the results are given in Tables 3 and 4.

Table 3: What effect has already appeared or is expected to appear in future

	MLIT	Local Government	Construction Company	From previous survey
1. Decrease in nonconforming works	✓	✓	✓	up
1) Decrease in the # of accidents				--
2) Completion on time				--
3) Improvement of work performance	✓	✓	✓	--
4) Establishment of quality management systems by the company	✓	✓	✓	--
2. Fairness and Transparency	✓	✓		no change
3. Promotion of competition	✓	✓	✓	down
4. Prevention of dango	✓	✓	✓	no change
5. Expansion of opportunities for participation				no change
6. Improvement of accountability	✓	✓		up
7. Improvement of familiarity with the field		✓		down
8. Utilization of new technology				up

Note 1) ✓ is put in the item where more than half of respondents answer "yes."
Note 2) "—" means that question was not asked in the previous survey.

Both the client and construction company feel that the CEM is effective in "Decrease in nonconforming works," "Promotion of competition," and "Prevention of dango." The both parties also feel that there is still a room for improvement in

the method of evaluating and reviewing technical proposals. As compared with the previous survey, except for the item of "Evaluation and review of technical proposals" a larger ratio of people request for improvement. Although all related parties have been working hard to improve the CEM, this task is still "formidable." To respond to these requests, a major reform is now discussed and implemented.

Table 4: Requests for improvement of the CEM

	MLIT	Local Government	Construction Company	From previous survey
1. Time and cost associated with proceeding the procedure	✓	✓		down
2. Evaluation and review of technical proposals	✓	✓	✓	up
3. Disclosure of the evaluation results			✓	down
4. Cost of developing technical proposals				down
5. Effects preventing low bid		✓	✓	down
6. Consistency between technical proposal and the ceiling price			✓	down
7. Expansion of awarded opportunities for local companies		✓	✓	down

Note: ✓is put in the item where more than half of respondents answer "yes."

COMPARISON BETWEEN THE JAPANESE REFORMS WITH THE BEST VALUE APPROACH

Strength of the scheme in Japan from the viewpoints of the best value approach

Representative principles of the Best Value Approach developed by Kashiwagi are a) Paradigm shift, b) Client should be accountable first, c) Utilization of Past Performance Information, d) Transfer risk to vendors, e) Importance of Pre-Award Meeting and Risk Management, and f) Nontechnical evaluation.

The Act of Public Account in Japan stipulates that general competitive bidding is the due bidding scheme. However, the designated competitive bidding was introduced as an exceptional case, and this scheme has been used as a main bidding scheme for more than 90 years. This demonstrates that the low bid paradigm, that is, "price competition to satisfy detailed specification is the best method," has been uncommon in Japan.

The notion of "Client should be accountable first!" is now widely understood in the construction industry in Japan. A research team was established in 2000 to study how to define the client responsibility and how to fulfil it in infrastructure development and management. This responsibility is defined as "the responsibility of procuring and providing services or goods with good quality in a timely manner at inexpensive price."

Most of the public clients and the private companies have no resistance against using the past performance information. Designation has been made based on the past performance. After the general competitive bidding was introduced instead of the designated one, CORINS was developed. It is now widely used by both the clients and the private companies and become one of the most successful business

models in the construction IT systems. The project performance score also plays a vital role in selecting high performers and supporting the CEM.

Actually the Japanese government is developing and implementing three levels of feedback loops in social capital management in a transparent manner. Minor cycle is the mechanism which can ensure achievement of high quality products from each work. Intermediate cycle is a mechanism which appropriately reflects the past performance of a vendor in the next vendor selection. Major cycle is the mechanism by which experience at each stage of the project life cycle is steadily handed over to its subsequent stage throughout the whole construction production systems and fed back to its upper stream stage. These types of feedback mechanisms are considered essential to keep the performance of construction industry in not only Japan but other countries.

Regarding the risk transfer to the vendor, concept of "responsible construction" has been commonly practiced in Japan. For example, to construct facility truly suitable to the site conditions, it had not been uncommon for a vendor to voluntarily make a minor modification of the design document and execute it. High performing vendors had been willing to take risk and assist the client.

Importance of Pre-Award meeting & Risk Management on site is well discussed. Three parties discussion is recently introduced among the client, consultant, and contractor. To ensure quality, an attempt is made to focus on quality management of each construction process more carefully.

The principle of nontechnical evaluation seems the only major difference between the reform direction headed by the MLIT and the best value approach. The technical evaluation has been possible with high quality in-house engineers and much richer human resources than most of other public client organizations.

Weakness in the Japanese Scheme

However, there is a big concern. In many projects bids concentrate around "the lower limit," and the bid competition substantially becomes price competition. It is becoming more difficult to take a proper balance between the price and non-price part.

Local governments face more risky situations of falling in the low bid paradigm than the MLIT. First, the local government has more direct pressure to be "fair" and "cost efficient" procurement from the local residence. Second, local governments with an insufficient number of engineers are feeling a big hurdle and giving up in introducing the CEM and the evaluation of project performance score, which are practiced by the MLIT. As a result, in more projects, multiple bidders bid at the lower limit and the awarder is determined by tossing a coin. Acceptance of this selection process shows a possibility that governmental officers already fall in believing the low bid paradigm.

The consequent risk to falling in the low bid paradigm is prevalence of the vice circle that existence of poor performers creates poor quality work, which leads to survival of poor performers. Ninomiya (2011) develops and runs a simulation model to represent the survival situation of local companies when the contract

awarder is kept determined by tossing a coin. The simulation results hint a possibility that high performers would be out of business due to hard luck in the long run. These phenomena are also observed in many other countries.

If poorer performers start executing public projects, ambiguous position of supervising scheme in Japan could be a big factor to induce the second risk of the vice circle. The "Action Guidelines for ensuring the quality of public works" states that "The supervisor should not give unnecessary guidance to blur responsibility sharing between the client and vendor or make unnecessary confirmation to lead to cost increase." This inappropriate supervising and risk sharing gives a room for survival of poor performers.

Possible areas to be strengthened

First, inappropriate risk sharing should be avoided through clarifying the position of supervision. Though there is a view that supervision is not needed anymore, its functions of directing design document changes and technical judgment on contract alterations are indispensable in site management. Careful discussion is desirable about the future of the supervising scheme.

Second, it is worthwhile studying how feasible and accountable nontechnical evaluation of proposal and performance of each vendor would be. Actually, the MLIT has ordered one social experimental project to which nontechnical evaluations was applied. In this CEM project, selected bidders' presentations were non-technically evaluated by residential people, and their evaluation results were incorporated into the technical score of each proposal (Kurauchi 2011). In this case the best proposal selected by the client and the residential people happened to be the same. In order for the public client in local governments to be truly accountable, alternative method of proposal and performance evaluation including nontechnical one should be seriously studied.

CONCLUSIONS AND RECOMMENDATIONS

Comparison between essences of public bidding reforms in Japan and principles of the Best Value Approach shows some ideas on future of public bidding scheme. One of Japan's strength, various levels of feedback loops in social capital management, is considered essential in maintaining and improving the performance of construction industry. The position of supervision should be clarified to always realize appropriate risk sharing between the public client and the vendor. In order for local governments with insufficient engineering resources to be truly accountable, it is worthwhile studying alternative evaluation method of proposal and performance including non-technical one.

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UNIQUENESS OF PIPS/PIRMS MODEL

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ABSTRACT

Although some reports have shown the performance of the construction industry to be improving, it has yet to find a solution to ensure high performance on construction projects and services. Over the last 18 years, many public organizations have tested a revolutionary model created out of Arizona State University, called the Performance Information Procurement System / Performance Information Risk Management System. The test results have indicated that the model has the ability to ensure high performance on construction projects. This paper presents results of a literature review performed by a doctorial candidate, identifying different characteristics of the PIPS/PIRMS model from traditional management models. These characteristics could show why the PIPS/PIRMS model has been able to sustain performance while traditional models have fallen short.

Keywords: management, measurement, performance, procurement.

INTRODUCTION

In 1994, a landmark study was published by Sir Michael Latham identifying the continued failings of the construction industry in the UK (Cahill et. al., 1994). Latham's report was able to bring to the fore front many industry problems that had been identified for the last 30 years. Latham identified many of the current business practices as the reason for the adversarial environment, inefficiency, and low performance of projects. The report caught the attention of many buyers and suppliers in the construction industry and was the motivating factor in many industry initiatives in the late 1990's. However, after seven years, of industry reform and initiatives to boost performance, buyers and suppliers still were not satisfied with the performance of construction services. In 1997, the UK commissioned a task force headed by John Egan to perform another study to identify solutions to the industry's problems, this time approaching the situation from the buyer's perspective. The study identified a need for more leadership and integrated processes and teams. The Egan report (1998), like the Latham report, initiated many efforts to try and improve the performance of the industry. Despite the efforts initiated by the Latham and Egan reports, the performance of construction did not improve in the early 2000's and the industry has only recently seen slight improvement in certain areas of the industry. In fact, in many areas the performance of the industry has decreased. Overall efficiency and

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productivity of construction has struggled in the last decade (Georgy, 2005; Bernstein, 2003). Studies performed in the United States like those in the UK have shown suboptimal performance and low customer satisfaction in the construction industry (Adrian, 2001; Cahill and Puybaraud, 1994; CFMA, 2006; Chan, 2004; Chan, 2004; Davis et. al., 2009a; Davis et. al., 2009b; Egan, 1998; Flores and Chase, 2005; Hamel, 2007; Lepatner, 2007; Simonson, 2006; Post, 2000). The low performance have also given rise to disputes, claims, and litigation, creating even greater obstacles to improving industry performance (Childs, 2010; Doree, 2004; Glancy, 2008; Langlinais, 2011; Rijt, et. al., 2009; Wearden, 2008; Egan, 1998).

The most recent KPI report out of the UK has shown construction performance to be improving from 2000 to 2011 (Industry Performance Report 2011):

1. Overall Customer Satisfaction increased from 63% to 80%.
2. Projects completing on time rose from 28% to 45%.
3. Projects completing on budget rose from 50% to 63%.

However, despite the increases in performance from 2000, the construction industry still has room to improve. With only 45% of projects completing on time and 63% completing on budget, this is far from a high performing industry. The UK industry report also showed that the performances of construction services are still struggling with increasing their efficiency (Industry Performance Report 2011):

1. Contractor Satisfaction with client provision of information remained at 69% from 2010. This KPI increased only 5% from the initial measurement in 2003.
2. Contractor Profitability declined to 5% from 7.7% in 2010.
3. The clients rating of the amount of defects on projects declined to 68% from 75% in 2010. The client rating on defects on a project is only 3% higher than the initial client rating in 2000 (65%)

The declining profitability of construction companies and the amount of defects on projects show that the industry has not yet stabilized their performance. Although, the industry in some cases have seen improvements in performance and customer satisfaction over the last decade, the industry has yet to develop process that allows it to consistently deliver construction services efficiently (Adrian, 2001; Cahill and Puybaraud, 1994; CFMA, 2006; Chan, 2004; Chan, 2004; Davis et. al., 2009a; Davis et. al., 2009b; Egan, 1998; Flores and Chase, 2005; Hamel, 2007; Lepatner, 2007; Simonson, 2006; Post, 2000).

PERFORMANCE INFORMATION PROCUREMENT SYSTEM / PERFORMANCE INFORMATION RISK MANAGEMENT SYSTEM

The Performance Information Procurement System / Performance information Risk Management Process (PIPS/PIRMS), was developed by Dr. Dean Kashiwagi, out of Arizona State University (Kashiwagi, 2012). PIPS/PIRMS was another solution to try and improve the construction industry's inefficiency and low performance. With its unique management philosophy and technology it claimed to be able to minimize all of the current problems the construction industry was facing. After being tested over

the last 18 years, the process has shown it has the capability to deliver high performing construction work and services (PBSRG, 2012):

1. Over 1000 tests and $12M of industry funding to conduct the tests.
2. Delivering of $4.4B of services.
3. Copyrighted and licensed to 26 different research clients (most licensed technology developed at Arizona State University (ASU)
4. The Dutch Ministry of Transportation received the Dutch Sourcing Award for 2012, due to its implementation of PIPS/PIRMS on their $1B fast track infrastructure projects.
5. Tested all over the world (Botswana, Netherlands, Malaysia)
6. Vendors increased their profit margin by 5%. (State of Hawaii report, 2002; University of Minnesota Report, 2011).
7. Minimize management transactions by as much as 90%.
8. 50% of the time the awarded best value is the lowest cost.
9. Customer satisfaction is at 98%.

A CIB Task Group (TG61) performed a worldwide study identifying innovative construction methods with documented high performance results. The study filtered through more than 15 million articles and reviewed more than 4,500 articles. In the end the study found only 16 articles with documented performance results. PIPS/PIRMS was one of three construction methods found in those articles, and it was found in 75% (12 of 16) of the articles (Sullivan, et. al., 2008).

PIPS/PIRMS Process

PIPS/PIRMS has three phases (Figure 1). The phases are selection, clarification of proposal, and the award of contract and risk mitigation.

Phase 1 is identified as the PIPS. It is a best value selection process that identifies the best value supplier through a series of five filters (Figure 2):

1. Past Performance Information - The suppliers must show satisfaction rating of services performed for past clients.
2. Project Capability - The suppliers are required to submit three documents (project capability, risk assessment, and value added) that will be evaluated by the buyer's selection committee. The three documents must show how the supplier can deliver a high performing project through their experience and expertise, ability to foresee and mitigate risk, and ability to add value to the project.
3. Interview - The supplier's core team that will be assigned to the service will be questioned by the buyer's selection committee. The focus of the questioning will be to identify the team's ability to mitigate risk.
4. Prioritization - Through a weighting system and a linear model the suppliers are ranked on their ability to deliver value.
5. Dominance Check - The buyer checks all information on the highest prioritized supplier, including their cost, to ensure there is no information that would cause the buyer to select a different supplier.

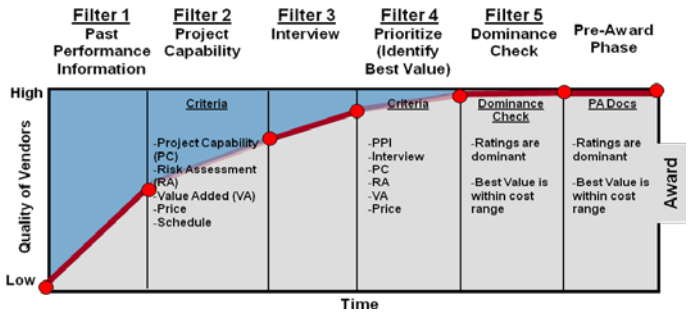

Figure 2: PIPS Filters

After Filter 5 only one supplier moves into the Clarification Phase (Phase II). Phase II and III is considered the PIRMS. During Phase II the supplier will finalize the contract, pre-plan the entire project, and finally obtain contract award. In Phase III the supplier will be expected to track all deviations that occur throughout the length of the service/project. Phase II has been identified as the most critical of the steps for ensuring high performance and customer satisfaction on a project/service. The success of the system was derived from the leadership concepts built into its management model. Research has verified that buyers did not need to run the PIPS to achieve high performance results on their projects, but the PIRMS was enough to ensure project success (Kashiwagi, J. et. al., 2009; Kashiwagi D. et. al., 2010).

HYPOTHESIS AND METHODOLOGY

The author proposes that the PIPS/PIRMS process has unique management/leadership traits that allow it to deliver high performing construction projects and services. If identified these traits could not only improve other construction methods and processes, but also management and delivery processes in other industries. To identify the unique management/leadership traits in PIPS/PIRMS the author performed a literature research that compared the PIPS/PIRMS model to other management systems in the construction industry. A "management system" defined as, any model describing how a buyer interacts with one or more suppliers in the construction industry. Information for the comparison was derived through a literature research (Kashiwagi, 2012).

PIPS/PIRMS COMPARISON LITERATURE RESEARCH

The following steps were taken to complete the literature research:

1. A search for all management systems
2. Identifying traits found in the identified management systems
3. Identifying traits found in the PIPS/PIRMS system
4. Analysis between PIPS/PIRMS traits and all other construction management system traits

Literature Search Process

To ensure that the search was organized and effective in identifying all available documented information on construction management systems the following procedure was setup and followed: 1. Keyword and database searching, 2. Searching

and filtering through literature, 3. Documentation of Information. The author wanted to keep the searches as broad as possible to minimize the chances of missing any management systems, thus the author used main scientific areas as search terms with "construction" in front of each term: Project Management, Risk Management, Supply Chain Management, Outsourcing, Quality Assurance, Quality Control, Performance Information, Purchasing, Contract Management. These keywords were used and searched in both academic and non-academic search engines to ensure that as much relevant information on construction management systems could be found. The main search engines that were used include: EI Compendex, Emerald Journals, ABI/Inform, and Google Scholar.

Table 1: Key Word Search Log

Search results are shown in Table 1. To identify relevant articles from the search results, the author read the abstracts of each article to see if a construction management system was discussed. The author found 55 papers that were relevant to the research. After exhausting the previously mentioned resources, an in depth search was conducted in order to locate the relevant articles that were identified as references in the articles returned by the search engines. Only articles that were published after 2005 were searched for. To find the referenced articles, the same four search engines were employed. This search also utilized several other search engines as well. The other search engines used included Illiad interlibrary service, ProQuest, ScienceDirect, ASCE Library, and Informaworld. The author found an additional 32 relevant papers from this method of research.

Information on the PIPS/PIRMS was collected from the following different types of publications: Books, Journal and Conference Publications, Government Reviews on the PIPS/PIRMS process. The Performance Based Studies Research Group has a database of all published works that have been written on the PIPS/PIRMS process, which was used to find all publications.

Construction Management Model Traits

The literature search found over 100 different management systems. The author reviewed each system and identified characteristics of each system. The author then categorized the characteristics of each system into 36 major traits (Kashiwagi, 2012):

1. Pre-planning
2. Communication
3. Collaboration and partnering
4. Shared accountability
5. Trust
6. Multi-Disciplinary Team
7. Early Supplier Involvement
8. Top Management Support
9. Contract Terms
10. Long-term contracts/relationships

11. Defining roles of key project individuals
12. Living Scope (allows scope to be molded throughout service/project life)
13. Scope of Service
14. Incentives and Penalties
15. Collecting information on project to make decisions
16. Measurement tools
17. Insurance and bonds
18. Document Structure
19. Training
20. Stakeholder Management
21. Delegate Responsibility
22. Knowledge Management System
23. Inspection
24. Buyer Decision Making
25. Buyer Performance Evaluation (buyer identifies if supplier is performing)
26. Third Party Certification
27. Risk Sharing
28. Identify Project Constraint
29. Technical Risk Mitigation
30. Computer Analysis
31. Simulation Technology
32. Buyer/Supplier IT system integration
33. Master Supplier (1 supplier takes care of entire project)
34. Hire experienced PM/ /facilitator/integrator
35. Hire a quality surveyor
36. Information Technology (IT system)

The frequency of each trait found in the articles is represented in the Figure 3. The numbers on horizontal axis correlate with the trait number found above. Traits 2 and 3 (Communication and Collaboration) being the traits that were most frequently referenced. The closest trait to the top two was Trait 16 (which was measurement).

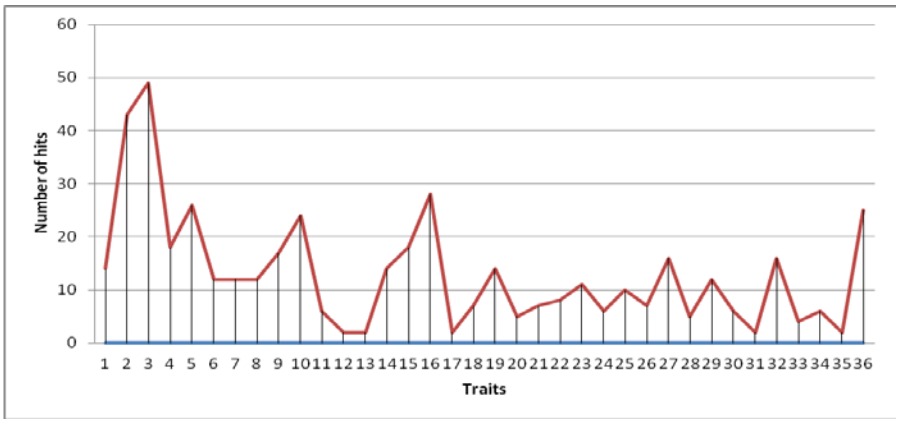

Figure 3: Trait Frequency Graph of Articles

PIPS/PIRMS Traits

After reviewing the literature on the PIPS/PIRMS the following 14 traits were found (Kashiwagi, 2012):

1. No-influence, no-control, no management philosophy
2. Seamless contract
3. Supplier contract creation
4. Require a plan
5. Problem Contracting
6. Communication Minimization
7. Expert Supplier Model
8. Dominant Information
9. Pre-planning

10. Senior/Top Management Support
11. Measurement Tools
12. Training Program
13. Stakeholder Management
14. Information Communication Technology

The PIPS/PIRMS traits were documented the same as the other construction management models (Kashiwagi, 2012).

Analysis Between PIPS/PIRMS and Construction Management Systems
After comparing the traits found in the construction management systems with those found in the PIPS/PIRMS, it was found that PIPS/PIRMS had six traits that were also found in the construction management systems, and 8 unique traits that could not be found in any other construction management system, which were as follows:

1. No-Influence, No Control, No Management philosophy - The client releases all control mechanisms (i.e. rules, requirements, oversight, etc.) and minimizes management of the supplier
2. Seamless Contract - Contract is used to mitigate risk instead of being a legal/regulatory/control document.
3. Supplier Contract Creation - The supplier creates the contract
4. Require a plan - The supplier is required to have a detailed plan and relay that plan to the client before a contract is signed.
5. Problem Contracting - System does not require the buyer to identify the scope of the project. The supplier creates the scope of the contract and the buyer approves it, before contract signing.
6. Communication Minimization - System tries to minimize all communication.
7. Expert Supplier Model - System assumes supplier has no technical risk and focuses on mitigating risk the supplier does not control.
8. Dominant Information - System tries to minimize decision making of all parties through simplification and presenting information that is interpreted the same by all parties.

In comparing the traits, some of the major observations that were found regarding the difference between the PIPS/PIRMS process and construction management systems were:

1. Many of the construction management traits were directly opposed to the "No-Management" philosophy of PIPS/PIRMS.
2. No other model required the supplier to have a plan before contract signing, mitigate risk they did not control, and use the contract as the mechanism to protect the supplier and minimize risk for the buyer.
3. No other model focuses on eliminating the sharing of technical details with the client, and forces all information to be dominant (i.e. simple, clear, succinct, etc.)

The closest traits to the PIPS/PIRMS that the construction systems identified were:

1. The act of trying to minimize problems and inefficiencies through pre-planning.
2. The industry found that measurement is vital to project success. The development of measurement tools and structures that measure the suppliers is an important movement. Unfortunately, the industry has found it difficult to find measurement systems that can truly differentiate the performance of suppliers and takes minimal effort to maintain.

CONCLUSIONS

The construction industry is in need of a process that can consistently deliver high performing and efficient projects/services. The PIPS/PIRMS model has documented high performance results from 18 years of testing. One of the reasons for its success is due to its unique leadership traits that have built its management system. It was proposed that identifying the unique management traits of PIPS/PIRMS could help to improve the construction industry's performance and efficiency. This paper reviewed a literature research that was performed to identify the unique traits of the PIPS/PIRMS management system compared to other construction management systems. The research found that out of 44 management traits identified the PIPS/PIRMS had eight unique traits that were not found in any other management systems. Identifying that some of the reasons why PIPS/PIRMS is successful could be due to:

1. The client releases all control mechanisms (i.e. rules, requirements, oversight, etc.) and minimizes management of the supplier.
2. Forcing the supplier have a plan and be capable of relaying that plan to the buyer before the contract is awarded.
3. The buyer holds the supplier accountable by forcing them to identify the scope of work, create the contract, measure their performance, mitigate risk they do not control, and relay all project information in dominant or clear and easy to understand terms.

The author proposes that with further testing and research the PIPS/PIRMS model could revolutionize construction management systems and drastically improve construction performance and efficiency.

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Utilising partnering to improve business outcomes in Housing Associations`

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ABSTRACT

Nearly 15 years ago, an industry changing report entitled "Rethinking Construction" was published. The purpose was improving the performance of the UK construction industry. The report outlined specific targets for improvement that were considered achievable through the implementation of certain processes. The report advocated partnering as the procurement method that could achieve the targets for improvement and identified the social housing sector as potential beneficiaries of this procurement model. Housing Associations are facing challenging economic conditions that may induce a reversion to lowest price traditional procurement. A review of these targets for improvement in terms of importance and perceived success through utilising partnering could ultimately provide more confidence to Housing Associations that perseverance with partnering could assist long-term value for money. A quantitative research methodology was adopted for Housing Associations to numerically rate the targets for improvement, in terms of importance and perceived success. The research concluded that the most important and potentially successful target for improvement achieved through partnering, considered by Housing Associations, was reduction in defects. The findings create an understanding of the current priorities of project deliverables for Housing Associations and also assess the perceived likelihood of achieving the targets for improvement through the utilisation of partnering.

Keywords: Housing Associations, partnering, procurement, targets for improvement

INTRODUCTION

An important publication that evoked change within the construction industry was entitled "Rethinking Construction", produced by Sir John Egan. The report identified specific practices which could be incorporated within the United Kingdom (UK) construction industry, which included a customer focus, collaborative team working and a quality driven agenda. Egan (1998) advocated the divergence of the UK construction industry away from the traditional fragmented philosophies to a focus on a collaborative working ethos, which can be translated through partnering. Egan (1998) believed that this basic transition of culture and structure within the UK construction industry was necessary if the benefits of partnering were to be achieved.

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In an attempt to justify the cultural change within the construction industry, moving towards the use of partnering, specific targets for improvement were set by Egan (1998). The targets included: capital cost reduction by 10%; construction time reduction by 10%; predictability increase by 20%; defects reduction by 20%; accident reduction by 20%; productivity increase by 10%; and turnover and profits increase by 10%. The UK social housing building sector was specifically identified as a potential beneficiary of the partnering ideology. Egan compliance measures were introduced by the Housing Forum (2002), which specified the utilisation of Key Performance Indicators (KPIs) and a commitment to partnering.

The subsequent report was published in 2002 entitled "Accelerating Change" and was the follow-up to assess the progress made since "Rethinking Construction" in 1998. Egan (2002) highlighted that the targets for improvement were being achieved and exceeded through measuring demonstration projects. The perceived benefits of partnering such as: effective cost control (Pheng, 1999); effective time control (Black et al., 2000); and improved quality (Brown, 1994) appeared to be justified upon publishing the results of the demonstration projects researched by Egan (2002). Consequently, Housing Associations in the UK have been encouraged for to utilise partnering agreements as the preferred procurement method for delivering construction and maintenance projects. The Housing Forum (2002) encouraged Housing Association clients to embrace partnering via long term strategic supply chain alliances. Fortune and Setiawan (2005) noted that Housing Associations involved in the delivery of new socially owned rented housing schemes have been lobbied indirectly through the widespread promotion of the recommendations by Egan, to adopt partnering agreements in improving the performance of projects.

An important consideration associated with the positive results detailed within the Accelerating Change publication and the continual endorsements for Housing Associations to utilise partnering is the chronological timeline of economic conditions within the last 10 years. These endorsements were vociferous during an economic period of prosperity, with ease of funding and investment into the construction industry. Currently, construction industries worldwide are facing unprecedented difficulties due to the reduction of available funding. These challenging conditions are also being faced by Housing Associations, with Gibb and Leishman (2011) emphasising the reduced funding available for new build social housing. The former Housing Minister in the Scottish Parliament, Alex Neil Scottish Government (2010), also highlighted to Housing Associations, that achieving value for money was an essential element to underpin the Scottish Government`s future investment programme in housing. This could tempt Housing Associations to revert back to traditional lowest price procurement in an attempt to drive prices down. Strongly opposing this strategy, Sir Michael Latham (2008) emphasised that if clients abandon best practice, close down frameworks, stop partnering, and return to lump-sum, single-tender contracts, based solely on lowest price, the industry will go back to its undesirable practices. It is therefore important to understand the importance placed by Housing Associations on the targets for improvement outlined by Egan (1998) nearly 15 years ago. This will identify Housing Associations priorities during the challenging economic conditions that have induced some clients to position low costs as the primary objective. Evaluating if Housing Associations believe that the targets for improvement can be achieved through adopting partnering during this economic climate may provide an understanding of the Housing Association perception of partnering and establish if a reversion to traditional lowest price tenders is likely.

METHODOLOGY

An initial critical analysis of literature was conducted to assess the key targets for improvement outlined by Egan (1998) and the corresponding results published four years later (Egan, 2002). Of the seven targets, five were selected for the research as they are more relevant to Housing Associations. These were capital cost reduction, construction time reduction, predictability increase, defects reduction and accident reduction. A quantitative research methodology was selected to identify the level of importance placed on these key targets for improvement and the perceived success from an exclusive Housing Association perspective. A questionnaire was compiled and distributed to Housing Association procurement personnel. This questionnaire was produced for respondents to rate their opinion on the level of importance associated with specific key targets for improvement and the levels of agreement for achieving the targets from adopting partnering. The Likert scale method was adopted for Housing Associations to rate the level of importance with the scale represented by 1 = very unimportant, 2 = not important, 3 = neither important nor unimportant, 4 = important, 5 = very important. The Likert scale method was also utilised for Housing Associations to rate the level of agreement that the key targets for improvement can be achieved through adopting partnering during the current economic conditions. The scale was represented by 1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree. The survey sample was compiled by utilising the Scottish Federation of Housing Associations information on the current Housing Associations operating in Scotland. The investigation enabled the identification of 90 Housing Associations in Scotland that possessed the capabilities of answering the questionnaire. From the 90 surveys distributed, 52 responses were received, providing a response rate of 58%.

KEY TARGETS FOR IMPROVEMENT

Capital cost reduction

The analysis of the quantitative data identified that 35 of the 52 Housing Associations (67%) considered capital cost reduction as either important or very important. The disseminated ratio of the 35 can be split between 25 as “important” and 10 indicating “very important”. Of the 52 Housing Associations, 8 (15%) placed neither importance nor unimportance on capital cost reduction. The data highlighted that 8 of the 52 Housing Associations (15%) considered capital cost reduction as “not important”. There was 1 Housing Association (2%) that considered cost reduction “very unimportant” The calculated mean level of importance placed by Housing Associations for capital cost reduction was 3.673. “Important” is represented by 4, therefore the mean response would be converted to 4 by rounding up to the nearest whole number. The mode is also 4, representing that “important” was the most frequently used response by Housing Associations. A maximum range of 4 was calculated as results ranged from 1 “very unimportant” to 5 “very important”.

When considering the level of agreement placed by Housing Associations on capital cost reduction being achieved through partnering, 31 of the 52 Housing Associations (59%) considered this achievable. 24 Housing Associations “agreed” and 7 Housing Associations “strongly agreed”. Of the 52 Housing Associations, 16 (31%) “disagreed” highlighting that they do not believe that 10% capital cost reductions can be achieved through partnering. The data indicated that 5 of the 52 Housing Associations (10%) “strongly disagreed” that adopting partnering would achieve the target construction cost reduction. The calculated mean level of agreement placed by Housing Associations was 2.635. As “agree” is represented by 3 the mean response

would be converted to 3. The mode is 3, representing that "agree" was the most frequently used response by Housing Associations.

Construction time reduction

When considering the level of importance placed by Housing Associations on construction time reduction, 22 of the 52 Housing Associations (43%) considered this as either important or very important. This translates into a split of 16 Housing Associations considering the target as being "important" and 6 rating as "very important". Of the 52 Housing Associations, 18 (35%) placed neither importance nor unimportance on construction time reduction. The results indicated that 9 of the 52 Housing Associations (17%) considered construction time reduction as "not important". The data highlighted that 3 of the Housing Associations believed this target for improvement was "very unimportant". For construction time reduction, the calculated mean level of importance placed by Housing Associations was 3.250. As "neither important nor unimportant" is represented by 3 the mean response would be converted to 3. The mode is 3, representing that "neither important nor unimportant" was the most frequently used response by Housing Associations. Similarly to capital cost reduction, a maximum range of 4 was calculated.

The data revealed that only 30 of the 52 Housing Associations (58%) agreed that the construction time reduction target for improvement could be achieved through partnering. Of these 22 Housing Associations, 25 "agreed" and 5 "strongly agreed". Of the 52 Housing Associations, 15 (29%) "disagreed" highlighting that they do not believe that 10% capital cost reductions can be achieved through partnering. 7 Housing Associations (13%) "strongly disagreed" with achieving this target. The calculated mean level of agreement placed by Housing Associations was 2.538. As "agree" is represented by 3 the mean response would be converted to 3. The mode is 3, representing that "agree" was the most frequently used response.

Cost/Time Predictability increase

The data identified that 40 of the 52 Housing Associations (78%) believed that cost/time predictability increase was either important or very important. The 40 can be split between 28 as "important" and 12 indicating "very important". Of the 52 Housing Associations, 5 (10%) placed neither importance nor unimportance on cost/time predictability increase. There were 7 Housing Associations of the 52 (13%) that considered cost/time predictability as "not important". The mean level of importance placed by Housing Associations for this target for improvement was 3.865. "Important" is represented by 4, therefore the mean response would be converted to 4 by rounding up. The mode was 4, representing that "important" was the most frequently used response by Housing Associations. The calculated range of 3 was lower as none of the Housing Associations considered predictability increase as "very unimportant".

Cost/time predictability increase by 20% was a target that generally, Housing Associations considered achievable through adopting partnering as 39 of the 52 (75%) rated this target either "agree" of "strongly agree". 20 of the Housing Associations rated "agree" with a further 19 rating "strongly agreed". Of the 52 Housing Associations, 10 (19%) "disagreed" highlighting that they do not believe that 20% increase in cost/time predictability can be achieved through partnering. There were 3 Housing Associations (6%) that "strongly disagreed" that this target could be

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achieved. The mean level of agreement was calculated at 3.058, with a mode of 3, therefore represents “agree”.

Reduction in defects

Housing Associations appear to place significant importance on reducing defects as 43 of the 52 Housing Associations (83%) considered this as either important or very important. This translates into a split of 27 Housing Associations considering the target as being “important” and 16 rating as “very important”. Of the 52 Housing Associations, 5 (10%) placed neither importance nor unimportance on construction time reduction. Only 4 of the 52 Housing Associations (8%) considered reduction in defects as “not important”, with none of the respondents regarding this target for improvement as “very unimportant”. The calculated mean level of importance placed by Housing Associations was 4.058. As “important” is represented by 4 the mean response would be rounded down to 4. The mode is 4, representing that “important” was the most frequently used response by Housing Associations. Similarly to predictability increase, a range of 3 was calculated.

When considering the level of agreement placed by Housing Associations on reduction in defects being achieved through partnering, a significant 46 of the 52 Housing Associations (88%) considered this achievable. 13 Housing Associations “agreed” and 33 Housing Associations “strongly agreed”. Of the 52 Housing Associations, 6 (12%) “disagreed” highlighting that they do not believe that 20% reduction in defects can be achieved through partnering. None of the 52 Housing Associations “strongly disagreed” that adopting partnering would achieve the target reduction in defects. The calculated mean level of agreement placed by Housing Associations was 3.519. As “strongly agree” is represented by 4 the mean response would be rounded up to 4. The mode is 4, representing that “strongly agree” was the most frequently used response by Housing Associations.

Reduction in accidents

The results identified that 26 of the 52 Housing Associations (50%) considered reduction in accidents as either important or very important. The 26 can be split between 14 as “important” and 12 indicating “very important”. There were 17 Housing Associations (33%) that placed neither importance nor unimportance on reduction in accidents. Of the 52 Housing Associations, 9 (17%) considered this target for improvement as “not important”. The mean level of importance placed by Housing Associations was 3.558. Similarly to predictability increase and reduction in defects, none of the Housing Associations consider reduction in accidents as “very unimportant”. As “Important” is represented by 4, the mean response would be converted to 4 by rounding up. The mode was 3, as “neither important nor unimportant” was the most frequently used response by Housing Associations. Reduction in accidents had a range of 3 as none of the Housing Associations considered this target as “very unimportant”.

Reduction in accidents by 20% was a target that 30 of the 52 Housing Associations considered achievable through adopting partnering. 22 of the Housing Associations rated “agree” with a further 8 rating “strongly agreed”. Of the 52 Housing Associations, 19 (37%) “disagreed” highlighting that they do not believe that 20% reduction in accidents can be achieved through partnering. There were 3 Housing Associations (6%) that “strongly disagreed” that this target could be achieved. The mean level of agreement was 2.673, with a mode of 3, therefore represents “agree”.

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DISCUSSION

The research identifies the important targets and perceived success achievable through implementing partnering from a Housing Association perspective. The most important target for improvement considered by Housing Associations was reduction in defects by 20%, with a mean rating of 4.058. The second most important target was cost/time predictability increase by 20%, which scored a mean of 3.865, followed by capital cost reduction by 10% with a mean rating of 3.673. The two least important targets were reduction in accidents by 20%, with a mean rating of 3.558 and construction time reduction by 10%, which was scored a mean of 3.250. The most agreed with target that can be achieved from partnering, considered by Housing Associations was also reduction in defects with a mean rating of 3.519. The second most likely target to be achieved was cost/time predictability increase with a mean of 3.058. The third was reduction in accidents with a mean rating of 2.673, followed by capital cost reduction, which scored a mean of 2.635. The least agreed with target that can be achieved through partnering from a Housing Association perspective was construction time reduction with a mean of 2.538. Table 1 illustrates the results.

Table 1 – Synopsis of results

HOUSING ASSOCIATION IMPORTANCE LEVEL			
Target for improvement	**Mean**	**Mode**	**Rank**
Reduction in defects by 20%	4.058	4	**1**
Cost/time predictability increase by 20%	3.865	4	**2**
Capital cost reduction by 10%	3.673	4	**3**
Reduction in accidents by 20%	3.558	3	**4**
Construction time reduction by 10%	3.250	3	**5**
HOUSING ASSOCIATION LEVEL OF AGREEMENT			
Reduction in defects by 20%	3.519	4	**1**
Cost/time predictability increase by 20%	3.058	3	**2**
Reduction in accidents by 20%	2.673	3	**3**
Capital cost reduction by 10%	2.635	3	**4**
Construction time reduction by 10%	2.538	3	**5**

Unsurprisingly, Housing Associations place significant importance on reduction in defects. A primary factor could be maintaining tenant satisfaction that is measured through key performance indicators by Housing Associations. The results support Jones and O`Brien (2003) who highlighted the importance of tenant satisfaction for Registered Social Landlords (RSLs). Cost/time predictability increase is another importantly viewed target for Housing Associations. This could be attributed to the strict monitoring of budgets by housing Associations, not only for new build development, but also planned maintenance cycles. The importance level placed by Housing Associations on capital cost reductions was unanticipated, as a reasonable assumption would be that this target could have been the top priority due to the reduced grants and investment available for Housing Associations (Gibb and Leishman, 2011). There was still a substantial degree of importance placed capital cost reduction, acknowledging the need to make savings. Reductions in accidents and construction time were considered the least important targets for improvement by

Housing Associations. Quality and cost appear to be the main priorities for Housing Associations in the challenging economic conditions.

Housing Associations perception of the primary target that can be achieved through adopting partnering was conclusively reduction in defects. This supports Egan (2002) who believed that the ethos of partnering facilitates the development of quality consciousness. Housing Associations also appear to consider that cost and time predictability is more likely to be achieved through partnering than actual capital cost reductions or reducing the construction time. The Housing Association perception echoes Loraine and Williams (2000), who advocated that partnering provides increased certainty of out-turn cost and time. Housing Associations did not strongly agree that reductions in accidents, capital cost and construction time could be achieved through adopting partnering. 41% of Housing Associations disagreed that partnering could result in capital cost reductions. This perception challenges Cowan *et al*., (1992) who highlighted cost savings could be made through partnering. 42% of Housing Associations did not believe that partnering produce reductions in construction time, which contradicts the belief of Black et al., (2000) that partnering can reduce construction time as a result of better schedule performance. A reduction in accidents was not considered to be achievable through adopting partnering by 43% of Housing Associations. This challenges Chan et al., (2003), who suggested that collective responsibility of partnering can reduce the risk of hazardous working.

CONCLUSION

The three main priority targets for improvement for Housing Associations is reduction in defects, cost/time predictability increase and capital cost reductions. The reduction in defects is unsurprising, given the necessity for high levels of tenant satisfaction to be achieved through improved quality. Interestingly, Housing Associations place more importance on cost/time predictability increase than actual capital cost reductions. This was unanticipated as a reasonable assumption was that a consequence of the reduction in investment and funding could have resulted in an overwhelming need for capital costs to be reduced. There appears to be a degree of cynicism by Housing Associations as approximately a third of responses disagree that adopting partnering will not result in the achievement of the targets for improvement. Housing Associations priority of reduction in defects and the strong perception that this can be achieved through partnering could result in perseverance with the endorsed use of partnering. However, with a third of Housing Associations disagreeing with the notion of achieving the targets for improvement through partnering, a reversion to traditional procurement is possible.

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Legal, Ethical or Economic? Black and Minority Ethnic (BME) Peoples' Representation in Construction

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Abstract:
The construction industry forms a significant component of most economies and is responsible for a large share of revenue generation and employment creation. However, this very important industry suffers from a negative image as it has been characterised by a relatively low-status with unyielding and uncompromising working conditions hardly offering any job security. Regardless of these perceptions of construction, it is still characterised by a persistent culture of white male-dominance. The negative image of being identified with stereotyped white male values is said to adversely affect recruitment of minority groups to the industry notwithstanding that the white population is aging. As a result, Black and Minority Ethnics (BMEs) are proportionally underrepresented, despite alleged public commitment towards equality and intolerance of discriminatory practices. It has been highlighted that BMEs are generally unaware of the rights that protect them from racial and religious harassment in the workplace and resign to tolerance on the general notion that challenging the status quo may affect one's career prospects. This study therefore investigates the barriers they face causing their underrepresentation in construction and the consequences of these actions on their uptake and its industrywide effects.

Keywords:
BME, ethical, sustainable, diversity and employment.

1 Introduction

Nations have witnessed population diversities to the extent that monolithic blocks of workforce in organizations will leave them very uncompetitive on the global scene and in today's world of globalisation, this can be very detrimental. This has resulted in an unparalleled impetus for a relatively large number of studies on the effects of diversity at work and the construction industry is no exception. The need for the inclusion of minorities for the industry to be representative of the larger population is, in effect, paramount and has been covered in several studies (Caplan et al, 2009; Ahmed et al, 2008; Caplan and Gilham, 2005; Sodhi, 2004; Steele and Sodhi, 2004; Egan, 1998; Agapiou et al, 1995; Latham, 1994). However, studies into diversity at the workplace have generally yielded mixed results with some demonstrating that diversity can have negative effects by giving rise to communication difficulties thus affecting group cohesion and resulting in dysfunctional conflict (Jackson et al, 2003; Williams & O'Reilly, 1998). Yet, others (e.g., Caplan, et al 2009; Ahmed et al, 2008;

Dinsbach, 2005; De Vries & Pettigrew, 1998; De Vries, 1992) indicate otherwise and hence see no reason why such problems should occur.

The role migrant workers play in reconciling supply and demand of skilled labour in the UK construction industry needs serious scrutiny (Chan et al, 2011). However, Schaafsma, (2008) has noted that little attention has, so far, been paid to why inter-ethnic relations may be more harmonious in some work settings but rather more problematic in others as indicated by Jackson et al. (2003) and Milliken & Martins, (1996) while asserting that generally, relations between workers with different ethnic backgrounds have only been explored as potential mediators of the effects of diversity on work group outcomes. There is, as a result, little research into the experience of ethnic minority and majority employees and managers about how working in a diverse environment involving different ethnic groups can have positive or negative impact on productivity. Therefore, this article seeks to fill this gap by bringing to the fore the possible barriers that need to be understood and surmounted in order to create a positive inter-ethnic work relationship in construction. How do ethnic minority and majority members compare in dealing with inter-ethnic relations at work? And, whether either report on more positive or more problematic inter-ethnic relations. Is the former group over-blowing their experiences or is the latter covering up incidents of discrimination and how such issues are dealt with?

2 Background and Socio-economic Considerations of BMEs

The past few decades have seen Britain change from a country of net emigration to one of immigration at a trend influx of more than 100,000 immigrants annually (IPPR, 2010). Notwithstanding, improved economic performance in the UK relative to overseas has tended to increase immigration and rising UK inequality has had an even larger effect. Additionally, immigration policies at home and abroad have also helped to increase net immigration, particularly in the 1990s. According to the Labour Force Survey, some 4.5 million individuals living in Britain in the year 2000, 9% of the population, were born in another country (LFS, 2001). Many of these individuals of foreign origin work, and contribute to economic prosperity and well-being. And as supported by several studies, (e.g. Zimmermann, 2008; Dustmann et al, 2003; Shields and Wheatley Price, 2002; Dustmann and van Soest. 2001) differences in education, the demographic structure, culture, and skills of foreign-born individuals may have advantages in some labour market segments, but disadvantages in others and construction is classed in the latter category.

However, these disadvantages may diminish depending on the changes in the underlying factors and over time, immigrants may adjust in many respects to their UK-born peers, from the accumulation of skills, collection of information, and adoption of new habits. It is worthwhile to note that understanding how labour market performance of immigrants differs from UK-born, and from each other, how these differences relate to observed characteristics, and how they change over time is an important pre-requisite for migration policy. Also, it is significant to note that while adaptation and labour market performance of immigrant populations has been subject of intensive research in the US, Canada, Australia, and also in some European countries, according to Dustmann et al (2003), relatively little is known about the absolute and relative performance of the immigrant community living in Britain.

Notwithstanding, it is generally the case that when immigrants arrive in the destination country, their labour market productivity is likely to be different from that of their indigenous counterparts; a situation attributable to different levels of education, socio-economic characteristics, and different demographic composition. But even if an immigrant is compared, for example, with a UK-born of the same education and age, they may differ in labour market outcomes, like wages and participation. One important reason for this is that the skills immigrants have acquired in their home country are often not directly transferable to the host economy. Furthermore, immigrants may also lack certain general skills immediately after arrival in the host country especially fluency in communicating in the host's language as well as the observance of certain cultural practices. However, they may adjust over time to a level commensurate with the skills requirements of the labour market and in most cases acquire new skills. At this point, they may match or even do better in the level of local economic performance as well as assimilate into the hosts culture and hence the community.

Furthermore, Dustmann et al, (2003) note that differences in demographics, education or skills may but only be some of the reasons why immigrants differ in their labour market outcomes as they tend to settle in areas of more economic prosperity to take advantage of high levels of employment and wages and in most instances close to their predecessors and relations of similar origins. Consequently, this leads to selective settlement, as is the case in the South East and London regions and may cause a less even spread of immigrants and hence concentration in particular industries. This could result in more favourable labour market outcomes of immigrants and so underestimate the differences in economic outcomes between the hosts and immigrants and their descendants. Apparently, this ideal situation does not usually apply to immigrants as labour supply outstrips demand causing in its wake further unemployment thus worsening their plight.

2.1 The Impact of Economic Downturn on Future Skills Requirements

The preceding paragraph has noted that it usually happens in the case of an efficient labour market where the supply of skills is aligned with labour market demand that the supply and demand matching processes are seen to be deficient whenever there are mismatches between demand and supply for skills. As a result, considering the idiosyncratic, project-based nature of construction characterized by its reliance on a mobile, itinerant and largely self-employed workforce as noted by Chan et al, 2011 mismatches in the supply and demand of skilled manpower remains inevitable as the industry continue to remain adamant in opening to diversity.

Therefore, it is easier to assume that skill shortages, skills gaps and general unemployment have been controlled in the current situation. This fact is consistent with the Construction Trade Survey (2012), where organizations across the construction industry all reported a considerable decrease in skill shortages to a record low. For instance, for the first time since the survey began, relatively few employers experienced any difficulty recruiting site trades in 2012 Q1 as labour was plentifully available, without a single respondent suggesting any difficulty but for a modest increase in the number of firms reporting difficulty attracting appropriately skilled bricklayers and plasterers at 14% and 11% of respondents respectively.

Yet, looking at the recruitment activity, one in ten employers (10%) felt that there had been times when they lacked the number of skilled workers they required (ibid). Again, around half (52%) felt that they had been operating at around full capacity given the number of skilled staff they employed and still a third had not had enough work for their workforce (ibid). Also, it is worth noting that a more recent review of the Migration Advisory Committee (2009) recommended shortage occupations and listed civil engineers, mechanical engineers and welding trades while noting that although falling employment, vacancies and a high redundancy rate indicate that the labour market is in turmoil, it should not be assumed that all labour shortages disappear upon the acknowledgement that the removal of some construction-based occupations from the original list is in response to changing economic circumstances. Thus implying that the shortages experienced prior to the recession has only been marred by the downturn and could resurface sooner or later. Table 1 below shows the recent employment rate for construction as it compares with all other industries in the UK.

Table 1: Employment rate in Construction Compared with All Employment by Industry Sector (000). Source: Office for National Statistics, Labour Force Survey (2012)

	All in employment			***Construction***			***Real estate activities***		
	All	Men	Women	All	Men	Women	All	Men	Women
Jan-Mar 2010	28,72	15,28	13,442	2,201	1,966	235	261	118	143
Jan-Mar 2011	**29,1**	**15,5**	**13,57**	**2,20**	**1,94**	**254**	**296**	**131**	**165**
Apr-Jun 2011	29,15	15,63	13,520	2,187	1,931	256	305	143	162
Jul-Sep 2011	29,17	15,62	13,546	2,228	1,998	230	298	154	145
Oct-Dec 2011	29,20	15,63	13,568	2,165	1,934	231	290	150	141
Jan-Mar 2012	**29,1**	**15,6**	**13,54**	**2,14**	**1,90**	**236**	**331**	**177**	**155**
Change on year	*5*	*32*	*-27*	*-59*	*-40*	*-19*	*35*	*45*	*-10*
Change %	*0.0*	*0.2*	*-0.2*	*-2.7*	*-2.1*	*-7.4*	*11.8*	*34.4*	*-6.3*

As the data highlights in table 1 above, the construction industry has been significantly affected by the economic downturn, with the unemployment rate far exceeding the national average as indicated by the negative figures shown. Even the related real estate sector activities have been affected with -6.3% in female employment compared with a meagre -0.2% overall. Here it is worthwhile to note that the unemployment rate affects women employees more as noted by Wilkinson (2006) signifying that like these women, the industry has no room for BME professionals and people with disability who do not conform to the 'white, male , able bodied norm.

Therefore, it must be stressed that the impact of the recession across the construction industry has radically affected the mismatches between demand and supply. While on the one hand skills shortages and skills gaps have decreased dramatically, this has contributed to worsening unemployment. Although skills shortages are currently at an all time low, lessons need to be learnt from the previous recessions. One of the biggest risks to the recovery of the construction industry, according to the ConstructionSkills (2009) is a shortage of skills as people made redundant seek new careers outside the industry and new entrants unable to get jobs, look elsewhere. With a proportionally larger proportion of the population with a younger profile compared with an insignificant fraction engaged in construction as indicated in table 2, there is

the need for lessons to be learnt if the industry is to avoid a catastrophic future in meeting it recruitment requirements

Table 2: Employees and self-employed in the construction industry by ethnic origin in UK
Source: Labour Force Survey, Office for National Statistics (2012)

	Breakdown of Ethnic Minority[1]							
Four quarter average: Quarter 2 2010 to Quarter 1 2011	**All**	**White**	**Ethnic minority**	**Asian/ Asian British**	**Black/ Black British**	**Chinese**	**Mixed**	**Other**
(Thousands)	2,155	2,056	99	51	22	1	5	13
Percent	100%	95.4%	4.6%	2.4%	1.0%	0.0%	0.2%	0.6%

Notes: 1. The sum of ethnic minority breakdown does not equal the total due to insufficient data.

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As can be seen in table 2, only 4.6% of BMEs compare with 95.4% of Whites are employed in construction. It is therefore evident that little improvement, with respect to drives to improve the representation of ethnic minorities, has been achieved.

2.2 Employment and Engagement

The first two definitions of employment by the Oxford dictionary online given as '*the state of having paid work*' as in '*a fall in the numbers in full-time employment*' and the action of giving work to someone as '*in the employment of an engineer'* directly fit the description of this study. Again, the Cambridge business dictionary online defines employment as '*work that you are paid to do for a particular company or organization'*. The free dictionary online also gives *engagement* as a direct synonym of '*employment'*. Although employment is much broader, and engagement entails a level of commitment, it denotes the full commitment of an employee when the two terms are used together. In fact for the employee to be motivated to contribute their best to an organization they must be well engaged in consideration to the full ramifications of the term. In human resource management this is a very important phenomenon as it defines the success or failure of a business. Research by the Institute of Employment Studies (IES) has shown that when employees feel engaged, they feel more positive about their organisation which feeling leads to enhanced motivation, performance, job satisfaction and quality of working life. There is an increasing body of evidence that employee wellbeing and engagement has a direct relationship with positive business outcomes (Shutler-Jones, 2011).

Robinson et al, (2004) again delineate issues that help a clear view of the behaviours demonstrated by the engaged employee and are seen to have clear overlaps with the concepts of commitment and organisational citizenship behaviour. According to them, engagement is big in the HR consultancy market, yet there is a dearth of academic research in this area. In their study, engagement is more than a passing fad as it brings clear business benefits. Demonstrably, there is an equally strong relationship between engagement and the drive in most organisations (Macleod and Clarke, 2009) to ensure their workforce reflects the diversity of the UK's population as ensuring fairness and equal opportunities at work for all employees lies at the heart of engagement. The focus should, as a result be on trying to keep the widest possible pool of talent available which requires that all types of employees are considered (Stern, 2008).

In a bid to measuring engagement, attitude surveys of employees based on data from the Institute of Employment Studies yielded positive responses which identified issues that drive the willingness to go beyond the requirements of the job. These underpin the determination of the level of engagement sustainable in particular instances. It had been further revealed that engagement levels can vary, in association with a variety of personal and job characteristics and with experiences at work. Some key indicators of this fact included the finding that minority ethnic respondents have higher engagement levels than their white colleagues (Robinson et al, 2004). This fact is affirmed by the argument of the industry's unwillingness to adapt its current norms to diversity which is at the root of its persistent failure to reflect diversity in the society it serves. It is further noted that the industry is "vertically divided into distinct socio-economic groups raising a difficulty in knowing how to get more women and other minorities into the industry. Consequently, construction is compared to the army; with strong officer, supervisor, and cannon fodder classes where every man knows his place and *who* is above and below him (Johnson, 2003). With these characteristics, 'fitting in' is central if one is to be retained (CCI, 2010, Ahmed et al, 2008). Another important barrier besides having to fit a mould (Ahmed et al, 2008) is the observation that getting ahead in construction is often characterised by the importance of personal relationships where '*men tended to have chosen a construction career in response to a family member'* (Dainty and Bagilhole 2006) while *younger women tended to have embarked on a construction career as a result of targeted recruitment campaigns*" (ibid).

As a result, organisations need to work harder to minimize, or better, prevent, the impact of bad experiences. They also need to ensure that employees' development needs (including the special needs of professionals) are taken seriously; pay attention to, and value the roles of, support staff; and to maintain the interest of longer-serving employees. The relatively high levels of engagement of the oldest employees, and of minority ethnic staff, suggest sources of untapped potential within some organizations (Macleod and Clarke, 2009).

3 The Study

Therefore, in order to further investigate the underrepresentation of this *sustainable* source of labour to construction beyond literature, empirical data was collected from stakeholders in the industry. This entailed the collection of qualitative data using semi-structured interviews from construction employers (managers, supervisors etc.) in both large companies and Micro to SMEs through the use of snowball sampling. This was necessary due to the difficulty in recruiting respondents. Of the 22 interviews (referred to as RP1 –RP22), 8 were conducted in the North West of England while the remaining 14 were conducted in London and the South East. Additionally, 75 questionnaires were received back from respondents for a quantitative study alongside, which entailed a further 28 and 47 questionnaires from the North West Region and London and the South East Region respectively. In all 200 questionnaires had been distributed equally in both locations in this *pragmatism* oriented study. These were analyzed using Nvivo8 in the first case and SPSS in the second instance. Hence the mixed methods approach characteristic of the pragmatic paradigm (Creswell 2003) using strategies for data collection in a parallel/ simultaneous manner (WBI, 2007) was adopted through the use of techniques drawn

from both the quantitative and qualitative traditions. In the study, themes were identified and the discussion in this paper will be based on the single main theme outlined in section 4 below.

4 BME Employment and engagement barriers

For the purpose of this article the salient references as captured in Nvivo 8 relating to the theme 'BME employment barriers in construction' are capture and emphasised in order to drive home the issue at stake. It has been noted that England has become so diverse ethnically but the question still remains whether this diversity is reflected in the various institutions or there exist clusters of ethnicities visibly identifiable in sectors peculiarly identified as such. This theme was exhaustively reviewed by the respondents with all 22 of them contributing 46 references to the issue implying an average of two references each and in some cases three. The content and the context of such references will form the subject of discussion in this section.

Here, the educational level, the knowledge and expertise as well as the experience base of BMEs was called to question and is put in doubt. RP1 contends that some of 'them'- (BMEs), may suffer from lack of knowledge, education and familiarity with local issues implying the lack of knowledge of the local culture and goes on to say that if one has work experience in the appropriate field, it does not matter what race, being Asian, Black or White, a job could be obtained in construction; a point also confirmed by RP4, RP8, RP10, RP14 as signified by this quote: *"Lazy people always point accusing fingers. As they say, the bad workman … They don't want to train and so … blame their tools. Indians are everywhere. What about that. They are BMEs as well, aren't they?"(RP22)* But then the issue of the '*Indians are everywhere*' is rebutted by the argument that the industry is dominated by the white majority and if Indians happen to be the majority among the minority as indicated in table 2 where they constitute more that halve (2.4% out of the 4.6%) of the total BME employees in the industry and as noted by literature then their success reflects the character of the industry reminiscent of the White male dominance. Also where clusters are formed with dominance in some parts for particular minorities such practices could prevail. The remedy, as a result lies in something else and citing the incidence of over-education as noted in literature and elsewhere in this study point in a different direction.

Also, related to the issue of the lack of adequate training is that of language which was seen to be a problem but then again a rebuttal by RP18 had this effect: *"I not think so … people difficult to speak English but work is not speak ... know language too much plenty talk. A little English ... that's enough."(RP18*). It is evident that the language of the respondent has a lot of room for improvement and as an employer leaves much to be desired. Therefore the issue of language is given varying dimensions based on what is being considered. Alluding to scanty English as a means of getting employee to stay focused on their duties is how RP18 believes limited language skills can be an advantage believing that '*work is not speaking*" however noting the significance of explicit instructions.

The issue of racial and other forms of discrimination on ethnic lines have also been outlined in literature as a subject of much scrutiny. Being quite controversial an issue which a lot of people would avoid, it is quite sensitive to be discussed. However, it

featured a lot in the responses and it is believed that a little elaboration will do. Confirming the literature, the respondents made references to discrimination as not only meted out to minorities by the majority but the reverse is also the case and also, even amongst the minorities, there is a lot of discrimination. Therefore, it is common for companies, especially micro and SMEs to be characteristically dominated by clusters of particular ethnic groups.

Final to be discussed here is the major and dominant barrier raised which is the lack of network for the BME community in the construction industry as noted by Dainty and Bagilhole (2006) and Ahmed et al, (2008). Several respondents referred to the fact that recruitment is through informal referrals by staff and other known people who bring in relations and friends as confirmed by: *"I think in construction, it is best if you know somebody ... I remember ... a friend brought me to my first job" (RP 10).* This factor happened to be the most prevalent among the respondents and has been captured along with others into the model adapted from the Commission for Architecture and the Built Environment (CABE, 2005) on what it describes as *helping* and *hindering factors* on either side. The effects of these factors during the employment process are graphically demonstrated depicting a reduction in numbers from education and training through job seeking to senior management respectively (Figure 1). The model shows this effect as the involvement of BMEs narrows down along this process.

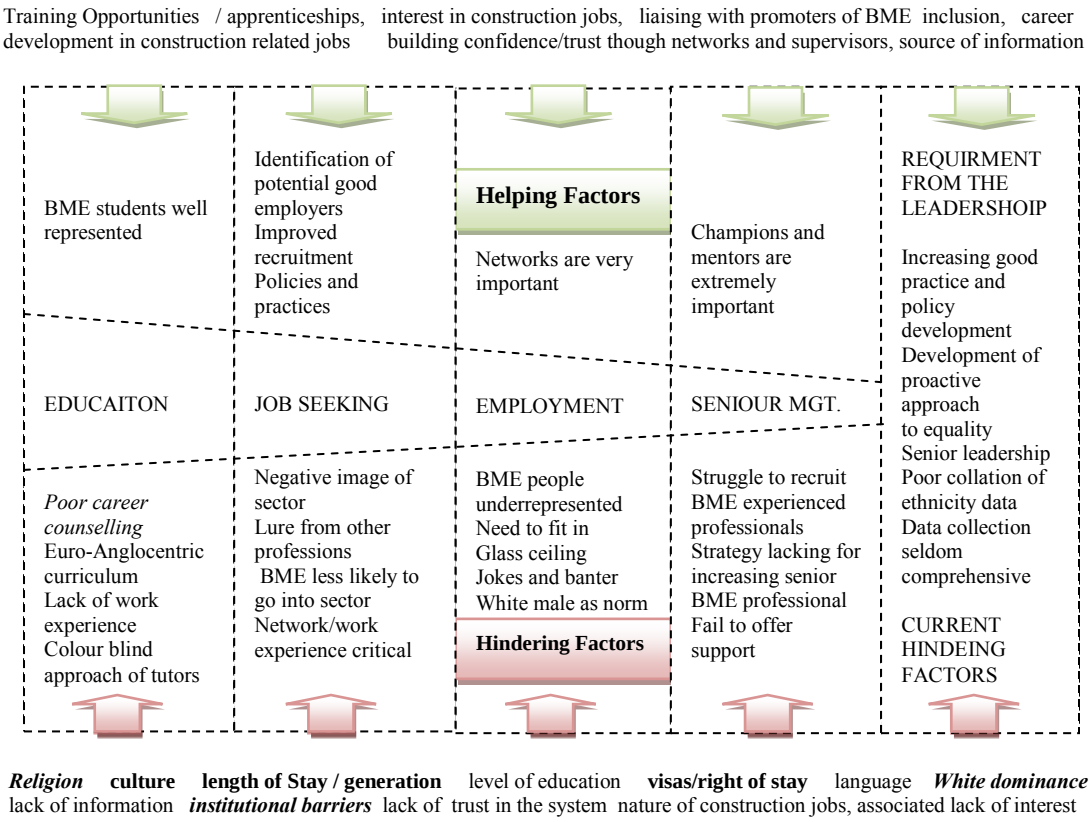

Figure 1: Model of helping and hindering factors excerpted and adapted from CABE (2005)

The factors as noted in the two instances of helping and hindering factors in figure 1 stress the importance of networks as noted earlier thus confirming the tendency of *like*

attracting *like* and rather contradicting the law of magnetism. The adage '*birds of a feather flock together'* therefore becomes the norm and hence the formation of clusters of ethnicities in particular job locations. The issue of trust and commitment which hints levels of engagement as discussed in section 3 is seen to be pivotal here.

Additionally, as a corroborative study, the quantitative analyses concentrated on the importance of networks in gaining access to the industry as confirmed in literature and in the qualitative part of the study. This point was arrived at by the correlation between two variables '*Relation in industry'* and '*mode of entry'* in both regions, as indicated in figures 2a and 2b. In the figures, it is evident that strong networks in the industry are a determinant of the opportunities open to potential employees.

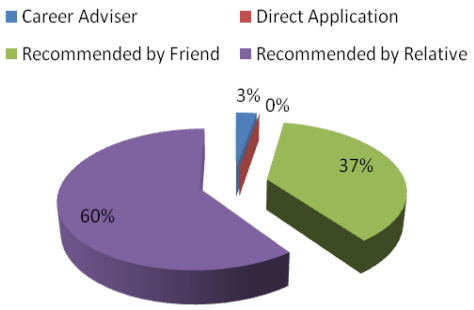

Figure 2a: Relation and mode of entry (SE)

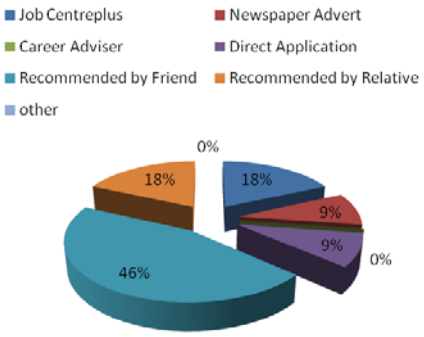

Figure 2b: Relation and mode of entry (NW)

The percentage of the respondents in both regions who gained accessed is evident and indicative of the evidence tended by Dainty and Bagilhole (2006) that '*Men tended to have chosen a construction career in response to a family member ...* implying that they were attracted by relations in the industry. In the case of the South East (SE) in figure 2a a whopping 60% of the respondents were attracted by relative with a corresponding 18 in the North West, while 37% and 46% respectively gained access through friends. Going by these figures, it is confirmed that networks are a crucial means of entry into construction.

4 CONCLUSION

In effect, it has been noted that the foregoing points to the variety of sources of the barriers facing prospective entrants into construction in the United Kingdom. Ethnic minority workers may be disadvantaged by their own characteristics in what might be regarded as internal barriers, yet other distinct factors and external barriers are at play. The Labour Force Surveys (LFS) data indicate that 16% of those whose first language is not English claimed that language difficulties caused them to have problems in finding or keeping a job. Also, data from the Fourth National Survey of Ethnic Minorities report that lack of English language fluency reduces average predicted employment probabilities by 20-25 percentage points. In most dimensions of economic and social well being (such as income, employment, education, social class, health, housing etc.) there is a clear ethnic hierarchy with Indians and Chinese at the top, Black Africans and Caribbeans somewhat lower down and Pakistanis and Bangladeshis at the bottom. This stratification is not by accident and points to some of the evidence discussed in preceding sections.

This study, therefore, has stressed the importance of networks in the process of employment through retention and progression which has received confirmation in literature and in the empirical study. This mode of entry has tended to favour the White majority and as has emerged above the clustered majority amongst the minorities who have already been able to make their mark like the Asian or Asian British, particularly the Indians as indicated by some respondents. Such processes may derive from sources including public perception which has been thought to be prejudiced against people of other races other than the white majority yet it had also been noted that reverse discrimination is also possible. Cognisant of this fact, therefore, the formation of clusters and discrimination along such lines have not been ruled out hence the minority being disadvantaged in all respects.

In all this however, the United Kingdom policy interventions and existing national legislation need to be focused on stemming the tide by removing racial barriers to labour market integration. While it is clear that the weak labour market outcomes for ethnic minorities are due to a number of other causes as well that are beyond legislative control, it is also evident that a lot remains desirable in that respect. In particular, in the United Kingdom, policy is driven by the Race Relations Act (2000) that focuses on extending the duties required in the public sector to the private sector and as construction is mainly in the latter but heavily controlled and financed by the former, a lot of improvement of policy initiatives in place when properly implemented and monitored, (and the stress is on monitoring) may help stem the tide as recent positive stance on ethnic minority issues is encouraging.

These developments make further study on interethnic relations at work all the more warranted and targeting construction as the driver of most economies will go a long way to achieve the desired effect. In the workplace, people may have to interact with members of ethnic out-groups who they would perhaps avoid in their private lives. This may result in tensions, however if the workplace is oriented to a context in which people inculcate tolerance it may help to develop more positive attitudes toward each other as well as the common objective of fulfilling assigned tasks. There is also the need to consider whether the conditions of minorities are hyped and if some members of the native majority do not suffer similar fate yet shy at reporting it.

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CONSTRUCTION DELAY EFFECTS AND MINIMIZATION IN INDIGENOUS AND MULTINATIONAL FIRMS

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ABSTRACT

The issue of delay in construction industry is a global phenomenon and the construction industry in Nigeria is no exception. The study is to assess the effects of construction project delay and suggests methods to minimize them. A questionnaire survey was conducted to solicit the effects of construction delay and methods to minimize them from the indigenous and multinational construction firms. A total of fifty-eight (58) questionnaires were used for the analysis. The study revealed that time overrun; diputes, cost overrun, litigation/arbitration and project abandonment were the major effects of delay of construction projects. The five most effective methods of minimizing delay were frequent progress meeting, proper site management and supervision, proper coordination between the parties involved, proper material procurement and commitment to projects by all parties concerned.The study also established an empirical relationship between the methods employed in minimizing construction delay by both indigenous and multinational construction firms.

Keywords: construction project, delay, indigenous, minimizing, multinational.

INTRODUCTION

The Construction industry produces various resources, infrastructure, and facilities that aid the day to day human activities. Then the construction industry is vital to growth and development; its activities also forecast the general direction of an economy and for this reason, the industry is often described as a leading economic sector. Though, government spending is a major contributor to the industry, especially the infrastructure sub-segment, other sectors also contributed positively on the industry's growth.According to Aibinu and Jagboro (2002) a major criticism facing the Nigerian construction industry is the growing rate of delays in project delivery. Assaf and Al- Hejji (2006), define delay as the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project.A successful project is that, which accomplished its technical performance (in terms of quality and safety), maintained its schedule, and remained within budgetary cost (Frimpong Y.,et al 2003).The studies carried out in Nigeria by

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Odeyinka and Yusuf (1997) showed that seven out of ten project suffered delays in their execution. It was also observed that construction projects overrun their duration by 40 – 50% (Aibinu and Jagboro 2002).Ajanlekoko (1987) observed that the performance of the construction industry is poor in terms of time. Actually the problem of delays in the construction industry is a universal issue. In Saudi Arabia, Assaf and Al-Hejji (2006) found that only 30% of construction projects were completed within the scheduled completion dates and that the average time overrun was between 10% and 30%.

Construction contractors (firms) are usually categorised by several criteria.In Nigeria, the scope of operation is a common criterion.Researchers use this criterion to categorise contractors into either national (indigenous) or multinational (Samuel 1999, and Olateju 1991).National (indigenous) firms are those firms whose scope of operation is limited to Nigeria while multinational firms are those who operate in foreign countries as well as Nigeria.By virtue of their scope of operation, the former operates within existing regulations and standards in Nigeria which can be described as local regulations while the latter operates within local and foreign regulations and standards. Some multinational even pefer to adopt international regulations and standards such as Bristish Standard (BS), US Standards and International Standard Organisation (ISO) and so on.The indigenous construction firms are majorly one man business, but some are into partnership.Their organisation size vary between 1-3 staffs count,with an organisational structure comprising of the managing directors, a site personnel and a secretary.The size of their firm is determined by the ongoing projects so that cost of overhead for staffing is reduced, they rely more on casual staffs. In terms of equipments, finance, human resources, and so on the indigeneous firms were lacking behind compared to the multinational firms. The multinational firm comprise of mixed management of foreign expertriate and indigenous staffs. Their organisation capacity covers human resources, technical and managerial know-how, equipments, finance, technology, and information.Their organisation size vary between 4≥30 staffs count, with an organisational structure comprising the directors, management teams, operational teams, technical teams, support staffs and so on. Basically; those factors give the multinational firms a better performance than the indigenous firms.Ogbebor 2002, noted that 96% of the Nigeria construction industry is dominated by foreign contractors. On the grounds that indigenous contractors cannot be entrusted with complex project because they are incompetent.The issues of construction delays is particular to both the two firms' types, but the indigenous firms are most criticize for it than the multinational firms.

Different academic researchers have studied the causes of construction delays, its effects on project delivery in terms of time, cost and quality and methods of minimizing construction delays.Majorly, their comparism lies between professional respondents, contractors and the clients. The differential pattern between the activities and performance of the two types of construction firms in Nigeria in relation to construction delays has to be examined. The objectives of the study are to examine the effects of construction delays and the methods to minimizies it from the preception of both the indigenous and multinational construction firms. The paper also seeks to establish whether there is a statistical relationship between the preception of the firms' types.

Studies on effects of delays on construction projects

Delays in construction have so many effects which have been studied by few academic researchers. Li et al (2000) showed the effects as additional costs, decline in quality and rework, loss of productivity, late completion of project, increased time related costs, third party claims, and termination of contract. Aibinu and Jagboro (2002) studied and evaluated the effects of construction delays on project delivery in Nigerian construction industry. They discovered that the six effects of construction delay were: time overrun, cost overrun, dispute, arbitration, litigation, and total abandonment. Abdul-Rahman H. et al (2006) in their study found that delays effects were the disruption of work, loss of productivity, late completion of project, increased time related costs, third party claims and termination of contract.

Claims reinburstment issues between owner and contractor are always tense due to extra cost and time enlongation associated with delays.Thus, delay could generate distrust and create tension between the contractor, owner, and the owner's project management team according to Aibinu (2009). Ahmed et al (2002), stated that delay have a debiltating effect on clients, contractors, and consultants in terms of growth in adversarial relationships, mistrust, arbitration, cash flow problems, and a general feeling of trepidation towards each other.Aibinu and Odeyinka (2006) revealed that processing time and cost related claims associated with delays always generate dispute and further delays.

Studies on methods of minimizing construction delays

For a project to be successful; delays must be minimized or reduced.Aibinu and Jagboro (2002) identified two methods of minimizing delays which are: acceleration of site activities and contingency allowances. Odeh and Battaineh (2002) recommmend that reinforcement of liquidated damages clauses and offering incentives for early completion, developing human resources, adopting new contract award approach such as design-build and construction management contract type can minimize construction delays. A study carried out in Kuwait by Koushki et al (2005) identified methods of minimizing delays which include: ensuring an adequate source of finance, performance of pre-construction planning, allocation of sufficient time and money during the design phase, hiring of independent supervising engineer to monitor progress of work and ensuring timely delivery of materials and selection of competent and reliable consultants to carry out the work.Dayang (2009), identified proper project planning and scheduling, developing appropriate communication system linked to all functional groups, ensure the availability of resources, hiring a competent project manager and utilization of appropriate construction methods, incentive offer for early project completion and emphasizing on the availability of resources.Abudul-Rahman et al (2006) identified the procedures taken by contractor as to recovery of delays. From their survey, recommended procedures were increasing the productivity by working overtime hours or working by shifts, followed by asking for extension of time.

METHODOLOGY

A questionnaire was developed to assess the perception of the indigenous and multinational construction firms on the effects of construction delays and various methods that can be employed to minimize delays in construction projects in Lagos, Nigeria. The questionnaire was divided into three parts. The first part requested background information about the respondents.

The second part of the questionnaire focused on effects of construction delay among stakeholders. The eight effects of construction delay identified were: time overruns; cost overrun, dispute, arbitration, litigation, inability of client to get quick returns on investment, shortage of housing and project abandonment. Similar to the second part, in the third part of the questionnaire, the respondents were asked to highlight their preception on how to minimize the effectsof construction delay based on fifteen (15) factors identified. A five point likert-scale ranging from 1 (Not affect) to 5 (very great affect) was adopted to capture the effects of construction delay. Similarly, a likert-scale ranging from1 (Not effective) to 5(Very high effective) was used to measure the effectiveness of the methods employed to minimize construction delay.The sampling method used for the study was random sample techniques.The total of seventy (70) sets of survey questionnaire was distributed covering both indigenous firms (40nos) and multinational construction firms (30nos).Of the 70 questionnaires, Fifty-eight (58) sets (82.9%) were returned and there were 32 sets (55.2%) from indigenous firms and 26 sets (44.8%) from the multinational firms. The likert- scale adopted was transformed into mean score for each factors and ranked. Spearman Rank Correlation (Rs) was used to establish whether there is any form of significant relationship between the indigenous and multinational construction firms in relation to the effects of construction delays and the methods employed to minimize delay during construction project execution in the organisations.The hypotheses stated, were (a) H1: There is no statistical significant relationship between the effects of construction delays as perceived by the indigenous and the multinational firms. (b) H2: There is no statistical significant relationship between the methods of minimizing construction delays as precieved by the firm's types.

Spearman Rank Correlation (Rs)

$$Rs = 1 - \frac{6\sum d}{n(n^2-1)}$$

Test for significant (t)

$$t = rs\sqrt{\frac{n-2}{1-rs^2}}$$

ANALYSIS OF DATA

Demographic characteristic of respondents are given in Table1, according to the table, 32 questionnaires were received from the indigenous construction firms and 26 from the multinational firms. The designation of the respondents from the two types of firms differs; where majority were builder (36.2%). The work experience of the respondents lies more within 0-5 years for the indigenous firm's and 6-10 years for the multinational.The staff strenght of the multinational firms are more than the indigenous firms. Most of the firms specialize in building and civil engineering works.

Table 1: Demographic characteristic of respondents

Demographic Characteristic	**Indigenous**		**Multinational**	
	frequency	**Percentage**	**frequency**	**Percentage**
Firms types (questionnaires received)	32	55.2	26	44.8
Staffs strenght				
≤ 2	2	12.5	-	-
1-3	10	31.3	-	-
3-4	8	25.0	-	-
4-10	6	18.8	2	7.7

10-30	3	9.4	10	38.5
30≥	1	3.1	14	53.8
Respondents designation				
Director	7	21.9	1	3.8
Project manager	3	9.4	9	34.6
Builder	14	43.8	7	26.9
Site manager	2	6.3	6	23.1
Engineer/ Designer	6	18.8	3	11.5
Working experience (years)				
0-5	17	53.1	6	23.1
6-10	8	25.8	10	38.5
11-15	4	12.5	6	23.1
16-20	1	3.1	3	11.5
Above 20	2	6.3	1	3.8
Cost of projects executed				
1-5 million	2	6.3	-	-
5-50 million	20	62.5	-	-
50-150 million	7	21.9	3	11.5
150 million ≥	3	9.4	23	88.5
Field of specialization				
Building only	19	59.4	4	15.4
civil Engineering works only	2	6.3	2	7.8
Building and civil engineering works	11	34.4	20	76.9

Source: Field survey 2011

Effects of construction delay

The primary data collected from the second part of the questionnaire was analyzed from the perspective of the indigenous and multinational construction firms. The mean score was computed for each effect of construction delays to identify the most critical effects. The effects were ranked based on mean score values. From the ranking assigned to each effect of delays, the most critical effect as it concerns the two firms was identified. Based on the ranking in table 2, the five most critical effects of construction delays as preceived by the indigenous construction firms were: time overrun (4.06), dispute (4.00), cost overrun (3.91), project abandonment (3.72), and arbitration (3.51). The five most critical effects of construction delay as perceived by the multinational firms were: dispute (3.81), litigation (3.81), arbitration (3.80), time overrun (3.77), and project abandonment (3.58).From the above list, it is shown that the effects of construction delays on the two firms' types have a differential pattern. Thus, the effects were same but their critical level from the preception of the two firms differs. Based on the overall weight ranking for both the indigenous and multinational firms the five most critical effects were: time overrun (3.92), dispute (3.91), cost overrun (3.73), litigation/arbitration (3.66), and project abandonment (3.65).

Table 2: Effects of delay

Effects of delay	**indigenous Mean (x)**	**Rank**	**Multinatioal Mean (y)**	**Rank**	**overall weight(z)**	**Rank**
Time overrun	4.06	1	3.77	4	3.92	1
Dispute among construction parties	4.00	2	3.81	1	3.91	2
Cost overrun	3.91	3	3.54	6	3.73	3
Litigation	3.50	6	3.81	1	3.66	4
Arbitration	3.51	5	3.80	3	3.66	4
Project abandonment	3.72	4	3.58	5	3.65	6
Inability of client to get quick return on investment	3.50	6	3.08	7	3.29	7
Shortage of housing for people	3.19	8	2.92	8	3.10	8

Source: field survey 2011

From table 3, the spearman rank correlation coefficient calculated was 0.464 shows a weak positive correlation between the preception of the firms types on construction delay effects.The calculated value (t_{cal}) is 1.45 and the critical value (t_{tab}) is 1.895. Ho was accepted. This shows that the observation is not statistically significant.The differential pattern of the effects of construction delay on the indigenous firms and the multinational firms is below average.Hence, there is no statistical significant relationship between the effects of construction delay percieved by the indigenous firms and the multination firms.

Table 3: Spearman rank correlation of effects of construction delays

Variables	**Rs**	**df**	**t_{cal}**	**t_{tab}**	**decision**
effectsof delay	0.464	7	1.45	1.895	Accept H1

Methods of minimization of construction delay

The primary data collected from the third part of the questionnaire was analysed from the perspective of the indigenous and multinational construction firms. The mean score was computed for each method employed by the firms to minimize construction delays. The most effective methods of construction delay minimization were identified.Based on the ranking in (table 4), the five most effective methods of minimizing construction delays as perceived by the multinational construction firms were: proper site management and supervision (4.34), appointment of a competent project manager (4.34), commitment to projects by all parties concerned (4.34), frequent progress meetings (4.25), and proper material procurement (4.03). The five most effective methods of minimization of construction delay as percieved by the indigenous construction firms were: frequent progress meetings (4.27), proper coordination between parties involved (4.27), proper material procurement (4.23), proper information and communication flow (4.23), and proper site management and supervision (4.04).

Table: 4 Methods of minimization of construction delays

Methods of minimizing delay	**indigenous Mean (x)**	**Rank**	**Multinational Mean (y)**	**Rank**	**overall weight(z)**	**Rank**
frequent progress meetings	4.27	1	4.25	4	4.26	1
proper site management and supervision	4.04	5	4.34	1	4.19	2
proper coordination between the parties involved	4.27	1	4.00	6	4.14	3
proper material procurement	4.23	3	4.03	5	4.13	4
commitment to projects by all parties concerned	3.85	6	4.34	1	4.11	5
proper information and communication flow	4.23	3	3.94	8	4.10	6
Appointment of a competent project manager	3.62	9	4.34	1	3.98	7
use of appropriate construction methods	3.77	7	4.00	6	3.89	8
complete project feasibility study and site investigation	3.77	7	3.81	10	3.80	9
use of comprehensive contract documentation	3.50	10	3.72	12	3.61	10
use of experienced subcontractors and	3.27	11	3.84	9	3.60	11

suppliers						
Ensuring adequate cash flow for the project	3.15	12	3.81	10	3.48	12
use of multidisciplinary/competent project team	3.04	14	3.72	12	3.38	13
Enforcing liquidated damages and incentive for early completion	3.15	12	3.41	14	3.28	14
Absence of bureaucracy	2.50	15	2.78	15	2.60	15

Source: field survey 2011

The spearman rank analysis was used to study the relationship between the perception of the indigenous and the multinational firms on the methods employed to minimize delay in construction projects. The calculated value (tcal) is 4.07 and the critical value (ttab) is 1.76. $H_1$was accepted. There exists a statistical significant relationship in the preception of the indigenous and multinational construction firms on methods of minization of delay. The value of Rs is 0.652 which shows a strong positive relationship within the differential pattern of the preception of the two firm types (see table 5).

Table 5: Spearman rank correlation of methods of delay minimization

Variables	**Rs**	**df**	**tcal**	**ttab**	**Decision**
methods of minimizing delay	0.652	14	4.07	1.761	Reject H2

Discussion of results

The results obtained in the earlier section shows that the five most critical effects of construction delay (based on both firms types) as shown in table 2 were: time overrun (3.92) dispute among construction parties (3.91), cost overrun (3.73), litigation/arbitration (3.66), and project abandonment (3.65). The results confirm the study of Aibinu and Jagboro (2002).

According to Murali and Yau (2007) the causes of time overrun can be due to inadequate planning by the contractors, improper site management by the contractors, inadequate project handling experience of contractors, and delay in the payments for the work completed.

Cost overrun in construction project execution can be caused by change orders, mistakes, and discrepancies in the contract document. Disputes among construction parties can arise due to such factors as delay in the payments for completed work, frequent owner interference, changing requirements, lack of communication between the various parties, unforeseen site conditions, and problems with neighbors.Project abandonment can be caused by either, client-related, consultant-related, labor-related, contract-related and external factors (Murali and Yau 2007).In terms of disputes, dispute resolution is vital, and if not managed properly, can lead to abritration and litigation.

In Lagos, Nigeria, most project abandonment experienced were basically due to financial issues from client (individual, corporate and Government), death of the owner, change of government or policy and administrative-related issuses (corporate and government).

The five most effective methods of minimization of construction delays for the two firm's types were: frequent progress meeting, proper site management, and supervision, proper coordination between the parties involved, proper material procurement, and commitment to projects by all parties concerned. These factors, if well implemented by both the indigenous and multinational construction firms will reduce issues of delays in construction project execution.

CONCLUSIONS

The study focused on the effects of construction delays and methods employed to minimize the occurence of delays during construction project execution as percieved by both indigenous and multinational construction firms in Nigerian construction industry. The study revealed that the five critical effects of construction delays were time overrun, dispute, cost overrun, and litigation/arbitration and project abandonment. The effects of construction delays affect the performance of the industry and customer's satisfaction have not been met. Basic causes of delays in the construction industry should be addressed and the strategies highlighted by the stakeholders for this were frequent progress meetings, proper site management, and supervision, proper coordination between the parties involved, proper material procurement, and commitment to project by all parties concerned. The study revealed that there is a significant relationship between the strategies employed by the indigenous and the multinational construction firms in reducing or eliminating construction delays and delay effects on the two firms types differ slightly due to the nature of the organisation setup.

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CONSTRUCTION TIME: A PREDICTION MODEL WITH REFERENCE TO INDIAN CONSTRUCTION INDUSTRY

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ABSTRACT

Studies indicate that there is a relationship between project cost and construction time for different construction markets. The purpose of this study was to validate the time-cost relationship model developed by Bromilow et al. (1980) in context with commercial, residential, and industrial construction projects in India. The model was extended to include the magnitude of the projects in terms of gross floor area and project delivery methods to determine whether these variables also have an effect on project duration. Data related to 99 construction projects from all over India was obtained for the study. SPSS® program was used for analysis of the data. The statistical technique used for the analysis was stepwise linear regression. The results show a statistically significant relationship between construction time and magnitude of the project, measured by gross floor area, at the level of significance (*p*-value) of < 0.0001. This variable, when introduced in the model, presumably acts as a proxy for actual construction cost. A prediction model of construction time has been developed based on the results of the study. This model will be useful to students, both at graduate and undergraduate levels, who taking courses related to construction project scheduling and international construction.

Key words: Construction Time, Construction Cost, Gross Floor Area, Indian Construction Industry

INTRODUCTION

Construction Time and Construction Cost

Time and cost have been typically used as important criteria for determining project performance globally. Project cost has been identified as a correlate of construction time in many regions of the world (Bromilow et al., 1980; Choudhury & Rajan, 2008). In the construction industry, contractors usually use previous experiences to estimate the project duration and cost of a new project. In general, the more time it takes to complete an activity, the more human resources have to be engaged for the task, resulting in a higher project cost.

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A relationship between completed construction cost and the time taken to complete a construction project was first mathematically established by Bromilow et al. (1980). For the updated model, the authors analyzed the time-cost data for a total of 419 building projects in Australia. The equation describing the mean construction time as a function of project cost was found to be:

$$T = K*C^B \quad (1)$$

Where

T = duration of construction period from the date of possession of site to substantial completion, in working days
C = completed cost of project in millions of Australian dollars, adjusted to constant labor and material prices
K = a constant indicating the general level of time performance per million Australian dollar
B = a constant describing how the time performance is affected by the size of the construction project measured by its cost.

The model indicates that the duration of project time of a construction project is basically a function of its total cost. It provided a basis for all parties concerned with the construction process to establish a fairly accurate probable duration of a project in days, given the estimated cost of the project. The authors also analyzed the overruns on cost and time that provided a measure on the accuracy of the industry's time and cost prediction.

The model also indicates that relationship between duration of a construction project and time required to complete it is non-linear. In order to perform data analysis using a linear model, the variables need to be transformed into their natural logarithms.

Several other studies have been performed around the world to make similar predictions for either a specific sector of construction or construction industries, in general. Ireland (1985) replicated the study to predict construction time for high-rise buildings in Australia; Kaka & Price (1991) conducted a similar survey both for buildings and road works in the United Kingdom; Chan (1999) investigated the effect of construction cost on time with particular reference to Hong Kong; and Choudhury & Rajan (2008) conducted a study on residential construction projects in Texas. Hoffman et al. (2007) used Bromilow et al.'s (1980) time-cost model to analyze data collected for 856 facility projects. They, however, included certain other variables such as project location, building type, and delivery method in the model. All these studies found that the mathematical model developed by Bromilow et al. (1980) holds good for prediction of construction time when the cost of construction is known.

Construction Time and Gross Floor Area

Some studies suggest that building size is a better predictor of construction time performance than project cost. One of the first proponents of using building size as a predictor of construction time is Walker (1995). He suggests including gross floor area

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(which is measure of building size or magnitude) as an independent variable in the model to predict construction time performance.

Love et al.'s (2005) study takes a similar view. They argue that construction cost, when decomposed, consists primarily of labor and material costs. They argue that while labor cost is a function of time, material cost of a building is a function of gross floor area. The speed of construction, they argue, increases with an increase in the overall quantity of materials used. Therefore, the authors conclude that construction cost is not a "good" predictor of construction time performance. Instead, they advocate an importance on floor area as a viable alternative.

Given these considerations, gross floor area seems to be a promising factor for forecasting construction time of building projects. It may be worthwhile to find out whether this particular variable is a more reliable predictor of project completion time than cost.

Hypothesis

From a review of literature, it is hypothesized that

1. The actual construction time of building projects in India is affected by actual construction cost.
2. The actual construction time of building projects in India is affected by gross floor area of construction.

METHODOLOGY

Data Collection Procedure and Sample Size

Data for 99 construction projects were obtained from a database of construction projects maintained by the Indian Construction Industry. It was collected in Spring 2010. The projects consisted of residential apartment complexes and commercial buildings. All the projects were completed within last five years.

Variables and their Operationalization

Actual Construction Time (TIME): It is the actual time measured for the completion of a construction project. It was measured in months. This variable was labeled as LNTIME after being transformed into its natural logarithm.

Actual Project Cost (COST): It is the total cost of construction works of a construction project. It was measured in US Dollars. This variable was labeled as LNCOST after being transformed into its natural logarithm.

Gross Floor Area (GFA): It is the gross constructed area of a construction project. It was measured in square feet. This variable was labeled as LNGFA after being transformed into its natural logarithm.

RESULTS

Analysis

The time-cost relationship model developed by Bromilow et al. (1980) defines only the relationship between construction time and cost. Since the present study hypothesizes a

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relationship to exist also between (1) construction time and gross floor area and (2) construction time and construction cost, the model had to be modified. Following model encompasses both the variables that may have an effect on construction time performance:

$$TIME = K*COST^{B1}*GFA^{B2} \quad (2)$$

A stepwise linear regression analysis was used to perform the first step of analysis (see eqn. 3). It is a semi-automated process of building a model by successively adding or removing variables based on the *t*-statistics of their estimated coefficients. Therefore, the variables had to be transformed into their natural logarithms.

$$LNTIME = LNK + \beta_1\ LNCOST + \beta_2\ LNGFA + \varepsilon \quad (3)$$

Where

LNK = natural logarithm of K,
β_1, β_2 = regression coefficients, and
ε = error term.

The results of the analysis are shown in Table 1.

Table 1. Stepwise Linear Regression Analysis for LNTIME

Variable Retained	**Intercept (LNK)**	**Regression Coefficient**	***t***	***p*<|*t*|**	**Critical Value of |*t*|**
Intercept	-1.203		-4.378	<0.0001	1.96
LNGFA		0.367	15.568	<0.0001	
F-value of the Model = 242.354	*p*>Model *F*=< 0.0001	Model R^2 = 0.714 Adjusted model R^2 = 0.711			

Interpretations

The *F*-value of the model used for multiple regression analysis was found to be statistically significant at less than the 0.0001 level. This provides evidence that a relationship exists between construction time and at least one of the independent variables used in the model. The results, however, indicate only gross floor area is correlated to construction time at a very high level of significance with a *p*-value of less than 0.0001. None of the other variables, including construction cost, were found to be significant at level of significance of 0.05; hence, they were automatically excluded by the statistical package from the model.

An important aspect of a statistical procedure that derives model from empirical data is to indicate how well the model predicts results. A widely used measure the predictive efficacy of a model is its coefficient of determination, or R^2 value. If there is a perfect relation between the dependent and independent variables, R^2 is 1. In case of no relationship between the dependent and independent variables, R^2 is 0. Predictive efficacy of this particular model was found to be moderately high with an R^2 of 0.714, and an

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adjusted R^2 of 0.711. It means that at least 71 percent of the variances in construction time of educational projects are explained by gross floor area alone.

In order to have a visual understanding of the relationship between construction time and gross floor area, a scatter plot diagram was produced (Figure 1). The diagram confirmed the results obtained by stepwise linear regression analysis. A residual plot indicated a good fit of the sample data (Figure 2).

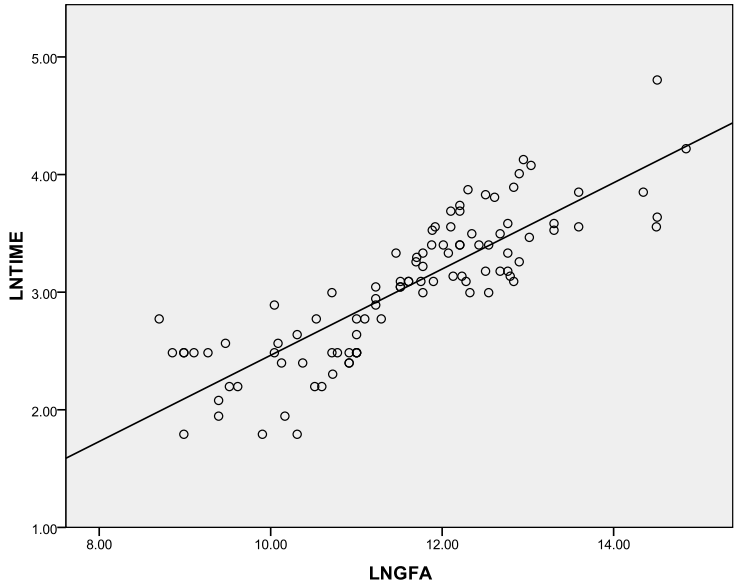

Figure 1. Relationship between LNTIME and LNGFA

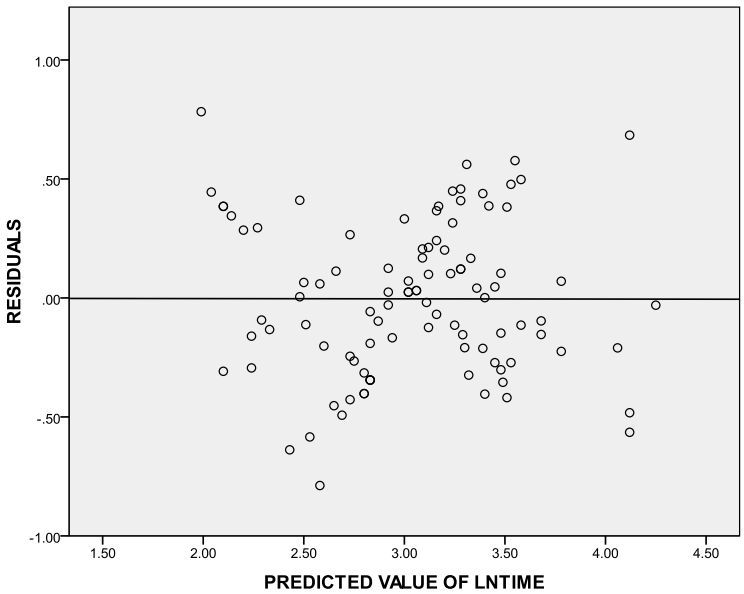

Figure 2. Residual plot

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Based on the findings, research hypothesis indicating a relationship between actual construction time and construction cost of building projects in India had to be rejected. However, the other hypothesis indicating a relationship between actual construction time and gross floor area of building projects in India could not to be rejected.

The prediction model for construction time of buildings in India was developed using results of the analysis. Bromilow et al.'s (1980) model was modified by replacing construction cost by gross floor area. The value of LNK was required to be transformed to K, using an exponential function [exp(LNK)], for expressing the model in its original form (Equation 4). The value was found to be 0.3. The model may be expressed as follows:

$$TIME = 0.3*GFA^{0.367} \quad (4)$$

This model can be used to predict the construction time for a building project in India when the gross floor area in known. For example, if the gross area of a construction project is, say 50,000 sft., the predicted construction time for the project would be about 16 months.

CONCLUSIONS

The results of the statistical analysis indicate that for a construction project in India, an increase in gross floor area results in an increase in total construction time. They also indicate that construction cost does not have to be included in the prediction model when gross floor area is available. In other words, this variable also acts as a proxy for construction cost. It can, thus, be assumed that gross floor area is a better predictor of construction time for construction projects in India.

The model will be useful for students of construction science, taking courses in construction project scheduling. It will also be useful for all parties associated with the construction industry to predict the mean time required for the delivery of an educational project. It provides an alternative and logical method for estimating construction time, both by bidders and clients, to supplement the prevailing practice of estimation predominantly on individual experience. The predict construction time for projects in other sectors.

This study has been conducted using data for construction of building projects in India. The construction industry can benefit from the results of the study by applying the model in predicting construction time for similar projects. Such models may be developed by collecting historical data either from the owners or the constructors. However, the model documented in this study applies only for construction projects in India and cannot be generalized beyond the sample size.

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ENABLING IMPLEMENTATION OF EARNED VALUE MANAGEMENT IN THE SPANISH CONSTRUCTION INDUSTRY

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ABSTRACT

The management of construction projects in Spain has been considered traditional and therefore need to integrate more contemporary project management techniques into its practices. The Earned Value Management (EVM) can be viewed as one of the project management techniques that represents the most fundamental principles of project management. Thus, promoting EVM as a common practice in the Spanish construction industry can be regarded an important step for the construction project management practices in Spain to increase its global competitiveness. Aiming to do so, this research project has been set to study the most appropriate way to promote the use of EVM in the Spanish construction industry. Initial findings from a questionnaire survey distributed to a sample population consisting construction practitioners in Spain are presented here. The preliminary outcomes of data analysis are discussed revealing the perception and practice of project management as well as the readiness of construction firms in potentially adopting EVM as the 'new' way of working in the Spanish construction industry. Subsequently, the most effective ways for implementing EVM in Spain can be formulated and this will support further research to recommend a set of guidelines to improve project management practices in the Spanish construction industry.

Keywords: Construction, Earned Value Management, Project Management, Spanish Construction Industry.

INTRODUCTION

Project management has continued to grow and develop into a multi-disciplined profession with its distinctive tools and techniques and has been gaining momentum in dealing with management of projects (Winch 2002). Its well established tools and techniques have assisted project managers in monitoring the current status measurements against the intended values at any point in time during the course of the project. However, in dealing with construction projects, many variables contribute to the projects' status. Most construction projects involve high degree of complexity, uncertainty and dynamics that may result in increased difficulties in managing these projects (Nguyen et al. 2004). These are usually exacerbated by continuous demands

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for various requirements including in speed, cost and quality control, health and safety, and so on, that further contributes to a vast increase in their complexity (Gidado 1996). Work progressing on a number of activities simultaneously has made them more difficult to monitor and review due to its multidimensional nature (Burke 2006). Thus many project managers may find it increasingly difficult to monitor and measure the true interpretation of the current status of their projects. Actual status can be measured, but not without potential inaccuracy and time delays. The desired status is also a subject to continuous changes as the project progresses and plans continuously evolving as a part of the dynamics. Regarded as a project management technique that embodies the most fundamental principles of project management in practice, the Earned Value Management (EVM) method has been considered a robust tool to help project managers in dealing with such complexity and dynamics.

In Spain, the concept of project management has been reported as slowly accepted and implemented (Pellicer and Victory 2006). Project management has been considered practically non-existence in the public sector (mainly in its construction) and slowly introduced into the private sector. Taking into account the importance of the construction industry to the Spanish economy and the pace of convergence of practice in Europe and the world, there is a major need for Spanish construction industry to further incorporate project management to improve its practices. Thus, adapting EVM in the Spanish construction industry can be perceived as an important milestone to bring the industry up to speed in the context of project management which will increase its competitiveness in the world. In an attempt of doing so, a research project has been set and hosted by the Department of Construction Engineering, Universitat Politécnica de Valencia in Spain. The aim of the research project is to investigate the potential introduction of EVM in the Spanish construction industry. The research project intends to study the contractors in the Spanish construction industry with the view to introduce EVM to the industry. In order to satisfy the aim, the following objectives have been set:

- to explore the appropriateness of adapting EVM in the Spanish construction industry,
- to analyse the readiness of the firms, human resources and infrastructure (including legislation).
- to recommend the most optimum but realistic way to adapt EVM in the contracting firms operating in the Spanish construction industry

EVM AND THE SPANISH CONSTRUCTION INDUSTRY

Earned Value Management (EVM) was originally developed in the United States during 1960s and has becoming one of the standard tools in the project management field. The Project Management Institute defines Earned Value Management (EVM) as “a management methodology for integrating scope, schedule, and resources, and for objectively measuring project performance and progress”. Performance is measured by determining the budgeted cost of the work performed (i.e. earned value) and comparing it to the actual cost of the work performed (i.e. actual cost). Progress is measured by comparing the earned value to the planned value (PMI, 2004, p. 359). EVM is implemented by establishing the budget, progress to be achieved in relation to the budget and the actual cost incurred in the project. By a constant comparison of these variables, cost and schedule variances can be monitored as well as the schedule performance index and cost performance index. Subsequently, the estimation

completion date, estimation completion cost and cost to complete can be calculated. Further details on the mechanics of EVM, its calculation further development can be found in various relevant textbooks and articles (e.g. Vanhoucke 2012, Anbari 2003, Brandon 1998).

By 1990s, EVM has been widely adopted in the United States, particularly in the defence and aerospace industries. The Department of Defence in the United States for instance, has been active in both promoting and requiring the use of EVM on its projects (Fleming and Koppelman, 2005). However, it became evident that the capabilities of EVM in managing and controlling projects has also been realised in other parts of the world. A survey (NAO, 2005) reported that EVM is mandatory for large projects not only in the USA, but also in Australia and Europe (particularly in Sweden and the UK). As a part of European Union, Spain and its construction industry is tightly linked with the rest of the Europe. Prior to the global financial crisis, the construction industry has been considered one of the most dynamic sectors of the Spanish economy. In 2007, the value of construction domestic output in nominal terms reached € 199,300 M and provided work for approximately 2.6 million workers (about 14% of the country's work force). The importance of the construction industry in Spain relative to the European Union zone can be illustrated by the significant proportion of Spanish construction industry as a percentage of GDP in comparison to other EU countries as follows (SEOPAN, 2007): Ireland (19.2%), Spain, (17.9%), Portugal 15.6%, Finland (14.6%), Netherlands (12.9%), Italy (12.7%), France (10.9%), Germany (10.2%), or the UK (10.5%). This shows that Spain is one of the largest European construction markets. Therefore, improvement in its construction industry will benefit the country in a large scale.

In Spain, the concept of project management has been reported as practically non-existence in the public sector (mainly construction) and slowly but painfully, trying to introduce itself into the private sector (Pellicer and Victory, 2006). The main issues in the Spanish construction industry include inadequate prequalification system, insufficient training, political considerations prevailing over real needs and an insufficient PM maturity (de la Cruz et al. 2006). This is made worse by the more 'traditional' management styles of Spanish managers that count on ad-hoc approaches and generally discard planning (Aram and Walochik 1997). In terms of the lower level of project management maturity in the Spanish construction industry for example, EVM can be seen as a potential way of improvement. Development of an integrated performance management baseline, such as EVM, will require a cultural change (Christensen 1998) to upgrade the project management maturity level in any organisations. This upgrade has been claimed as a way of achieving further competitive advantage (Jugdev and Thomas 2002). As EVM embodies the most fundamental principles of project management in practice, adapting EVM in the Spanish Construction Industry can be regarded as taking an important milestone to upgrade the industry in the context of project management which should increase its competitiveness in the world.

RESEARCH METHODOLOGY

In achieving the research aim and objectives, the overall research methodology in this research has been designed based on mixed methods approach with only the quantitative part (questionnaire) reported in this paper. Following a strong suggestion

within the research community that research, both quantitative and qualitative, is best thought of as complementary (Onwuegbuzie and Leech 2005), this mixed approach is adapted here with the view to explain a phenomenon from different angles. Informed by the literature review, questionnaire survey and follow up interviews involving construction project management practitioners in the Spanish construction industry have been selected to facilitate data collection in this research. In line with the aim and objectives of this research, the questions in the questionnaire were designed to capture the state of art of project management implementation in the Spanish construction industry as well as to investigate the readiness of the Spanish construction companies to implement EVM based on their current practices and capabilities. Follow up semi-structured interviews with senior project managers in the Spanish construction industry were planned to further explore the readiness of the firms, human resources and infrastructure aiming to explore potential scenarios of the most optimum but realistic way to adapt EVM in the Spanish construction industry. As earlier mentioned, the questionnaire survey and its initial findings are the focus of this paper and are discussed in the subsequent sections.

THE QUESTIONNAIRE SURVEY

The questionnaire technique can be defined as a general term including all techniques of data collection in which each respondent is asked to respond to the same set of questions in a predetermined order (deVaus 1996). A semi structured questionnaire combining Likert scale and ranking order with additional feedback spaces was designed for this research. Due to the exploratory nature of the investigation (not yet to generalise), the respondents were targeted with purposive sampling method implementing snowballing technique as described in Robson (2003). The targeted respondents are practitioners involved with managing construction projects in Spain for at least 5 years and involved in previous research conducted by the university. They have been involved with various construction projects in different regions of Spain with a majority of them are working for national and multinational construction companies in Spain. The number of the targeted respondents was sixty project managers. The questionnaire were originally designed in English but translated into Spanish language for clarity and practical reasons. 56 completed questionnaires were received. The characteristics of the respondents are provided in Table 1.

Table 1. Characteristics of the respondents

Number of responses analysed		56
Respondents' work position	Chief Executive Officer	5.35%
	Head of Department	39.28%
	Construction Site Manager	57.14%
	N/A	7.14%
Respondents' experience in construction (in years)	Min	5
	Max	31
	Median	14
	Mean	13

FINDINGS SO FAR

The findings from initial screening of the questionnaire survey can be generally grouped into two different categories, namely project management implementation in

the Spanish construction industry and readiness of construction firms in Spain to adopt EVM. Each of them is discussed in the subsequent subsections.

Project Management Implementation in the Spanish Construction Industry
Majority of the respondents (65.45%) did not consider project management concepts as novelties and, in fact, it is considered as a widely accepted concept in the Spanish construction industry. However, they also indicated that project management tools and techniques are only popular or used in certain construction companies. This is a classical symptom that has been found in other construction industries. Bennet (1983) when studying project management in the UK construction industry reported that although the essential requirements of managing tasks in construction projects were reasonably well understood, they were not widely applied in the UK construction industry or elsewhere. The formalisation of project management as a discipline with its particular techniques and tools was originally initiated and developed in the United States. Thus, their adoption in other countries may not be straightforward due to the potential differences in the industry's infrastructure, regulations or culture. In the case of Spanish construction industry, Pellicer and Victory (2006) even described project management as practically non existence in the industry. The awareness identified here, however, potentially provides a useful platform for any attempts to widening the implementation of project management in the future.

The focus of project management in the Spanish construction industry was found to be the cost which was ranked the 1st by majority of respondents and far outranked other areas including time, quality, health and safety, sustainability, client satisfaction and personal/public relations. Thus, most efforts in managing construction projects in Spain appeared to be dominated by cost controlling and, as indicated by Aram and Walochik (1997), it was typically done in a more reactive and ad-hoc manner. Potential dangers of this approach involve inefficiency, false economy and loss of opportunity to take meaningful actions in later stages of construction projects. Contemporary project management practices witnessed various attempts that have been made in overcoming the perceived inadequacies of classical dimensions such as cost, time and quality (Yu et al. 2005). For instance, other dimensions may have impact on long term reputation of the contracting firm and their chance for repeat businesses. Projects are no longer seen as one-off ventures but also as building blocks in the formulation and execution of corporate strategy which contribute to organisational success in terms of competitive positioning in the global marketplace (Dinsmore 1998). Accordingly, majority of the respondents (63.63%) concurred that there is a need for further use and application of project management tools and techniques in the Spanish construction industry. Considering the converging tendencies to use of EVM in the world, this has opened up the potential for EVM to be introduced and implemented in the Spanish construction industry as an important milestone to upgrade the project management practices in the industry with the view to increase its competitiveness in the world.

Readiness of Construction Firms in Spain to Adopt EVM
This part of the questionnaire explores the existing practices relevant to the collection of information required to implement EVM. Majority of respondents (80%) confirmed the use of a certain levels of Work Breakdown Structure (WBS) in the construction programme (schedule) in Spain during earlier phases of the project, i.e. pre-tender in estimating the project cost. However, they also informed that the

estimation of the project cost is mainly based on the quantity estimated which may not necessarily linked to the activities in the WBS or to the programme (schedule). WBS has been regarded a crucial tool in integrating schedule and cost information (Jong and Woo 2004). Thus, there appears to be a gradually looser relationship between the schedule and cost information as construction projects progress in Spain. 'New' construction schedules were developed based on the actual works requirement just before and during the construction phases using the quantity and amounts of money specified in the granted tenders as guidelines. This looser relationship between the schedule and cost information may pose a potential difficulties in implementing EVM into their practices as EVM requires exactly that for the determination of the planned values to be used as the baseline. Consequently, a 'success' in implementing EVM in the Spanish construction industry would also mean an improvement to their project management practices by further integrating the schedule and cost information.

Majority of the respondents (65.45%) informed that the tracking of projects' progress in the Spanish construction industry is typically done using the record of project expenditure (actual cost/expenses) so far. This can be considered a more 'traditional' project management practice that embodies what exactly EVM is moving away from. By segregating the earned value (progress to be achieved in relation to the budget) from the actual cost (actual expenditure to date), EVM provides a more accurate representation of the progress achieved in the project as measuring progress using expenditure can be misleading in many cases. Thus, this separation can be considered one of the fundamental advancements in the way of thinking in project management offered by EVM. Implementing EVM in such an environment will require shifting the mind set of the practitioners in the industry to appreciate the benefits and not perceiving EVM simply as additional tasks to them and a further monitoring/scrutiny from top management of individual performances. This internal resistance have been well documented and reported in literature as one of the main challenges in implementing EVM in an organisation (e.g. Bower 2007, Antvik 1998, Thamhain, 1998).

From the initial analysis, it became evident that the readiness in the Spanish construction industry to implement EVM is not very high, mainly due to the lower project management maturity level of many construction companies in Spain. The different levels of project management maturity portray a firm's evolution from immature project management practices to solid practices and the related infrastructure necessary to support projects at an organisational level. Following the definition of various project maturity levels described in Ibbs and Kwak (2000), this can be indicated as level 1 (ad-hoc) for small and medium construction companies and level 2 (planned) for large construction companies. However, more in-depth investigation is needed to draw a more accurate picture of the project management maturity level and readiness to implement EVM in the Spanish construction industry.

CONCLUSIONS AND FURTHER RESEARCH

Whilst becoming one of the 'standard' tools in the project management field, EVM has been adopted in many countries beyond its birth place in the United States. Meanwhile, the Spanish construction industry has been considered slow in utilising project management. Taking into account the convergence of practices and standarization in the world, there is a need for the Spanish construction industry to

accelerate the absorption process of project management concept, tools and techniques in its practices to improve its competitiveness. EVM has been considered the most suitable project management tool to achieve that. From the initial analysis of a survey involving practitioners in the Spanish construction industry, various potential barriers and enablers of implementing EVM in the industry have been identified and reported here paving path for the next stages of the investigation to take place. More in-depth analysis of the dataset as well as the outcome of follow-up interviews with practitioners will be reported in subsequent dissemination of this research project.

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EXPLORING MULTI-PROJECT MANAGEMENT IN CONSTRUCTION CONTRACTOR ORGANISATIONS

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ABSTRACT

Contractor organizations find themselves grappling with increasing complex projects and programmes, in the face of more demanding customer requirements, rapid technological advances, confusing stakeholder relationships, challenging and acute supply situations and an unending quest for improved performance. Parallel to this, there is increasing acceptance that programme management is the vehicle for achieving both organisational strategic objectives and aligning projects to overall strategy of the organization. Based on an empirical study and literature on programme management, the current reality of construction contractors' multi-project management is explored. The study reveals that contrary to the view that multi-project management must be applied in multi-project environments, Construction Contractors' in the main still apply single project management approach in delivering multi-projects. The paper identifies the barriers to contractor programme management and proposes that a framework for multi-project management in contractor outfit should include context. It concludes that understanding the environment Contractors' operate in will provide the first step to developing an approach that can deliver in a multi-project environment rather than utilising the single project paradigm. This will shift the focus from how best to deliver every single project as if they stand alone, to how effectively and efficiently multiple projects can be managed.

Keywords: contractor, framework, multi-project management, programme.

INTRODUCTION

Construction contractors usually have a number of projects going on simultaneously and therefore operate in a multi-project environment. Increasingly, projects are also procured through integrated routes which are complex and place greater responsibilities on contractors. Such responsibilities include dealing with unending client requirements, rapid technological advances, confusing stakeholder relationships, challenging and acute supply chain situations and unending quest for improved performance. The multi-project environment is also characterized by dependencies and interrelationships among projects being delivered simultaneously and within elements of any particular project system. There is however very little research on multi-project settings especially in construction, even though multi-

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project context and temporary systems are extensively common in contemporary business (Engwall and Jerbrant, 2003, Artto et al., 2009, Aritua et al., 2009). Notwithstanding the lack of multi-project context in research, programme management is increasingly accepted as the vehicle for effective delivery of multi-projects in achieving both organisational strategic objectives and aligning projects to overall strategy of the organization. This paper is a study of the actual management practices of construction contractors operating in such multi-project environment. The study reviews programme management literature to identify the key themes expounded as essential in multi-project management. Based on the empirical study and the key themes in literature, an analysis is carried out to identify the barriers to contractor programme management and a proposed solution to manage multi-projects.

The data for the study was gathered from five major construction companies in the UK. Data information was collected using semi-structured interviews of management level practitioners of these organisations. The research reveals that contrary to the view that multi-project management must be applied in multi-project environments, Construction Contractors' in the main still apply single project management approach in delivering projects. It concludes that understanding the environment Contractors' operate in, will provide the first step to developing an approach that can deliver in a multi-project environment rather than utilising the single project paradigm.

PROGRAMME MANAGEMENT

Managing single projects is fundamentally different to that of multiple projects. Mainstream literature in project management has been dominated by single project management approach as if organisations execute one or more projects independently or as loosely interdependent projects (Sacks, 2004). Managing projects in a multi-project environment is concerned with dealing with issues wider than in a single project environment. The generic principles within project management as applied across different disciplines as if "one size fits all" has therefore been identified as one reason for project failures (Maylor et al., 2006, Winter et al., 2006). To address the problem of using project management approach to manage multiple projects, programme management has increasingly been accepted as the preferred approach for providing a structured means of aligning, coordinating and managing a portfolio of construction projects to deliver benefits that would not have been achievable if the projects were managed independently (Lycett et al., 2004, Pellegrinelli et al., 2007, Reiss, 2003).

Approaches to programme management have been presented in variety of ways in literature by different authors (OGC, 2011, PMI, 2006, Reiss, 2003). According to Gray (1997) it is the integrated approach capable of streamlining the effective delivery of projects. In the UK, the publications by Office of Government Commerce (OGC) of *Managing Successful Programmes* (MSP) in 1999 and regular revised editions since then, has promoted programme management as the preferred approach for managing multi-projects in the public sector (OGC, 2011). Whilst there has not yet emerged an approach which is universally acceptable for programme management, there seems to be agreement that its use provides benefits which will not be if project management approach is adopted (OGC, 2011, Pellegrinelli, 2011, PMI, 2006). According to PMI (2006), managing multi-projects by means of programme management allows for integrated deliverables across the programme. MSP attributes to programme management, a framework that integrates and reconciles competing resource demands for the projects of the programme (OGC, 2011). The adoption of

programme management approach has also been proposed as that which allows for the application of broad management themes to help ensure the successful delivery of the programme. These themes are widely agreed by writers to be benefits management, stakeholder management and programme governance (OGC, 2011, Pellegrinelli et al., 2007, PMI, 2006).

The adoption of programme management approach for the delivery of multi-projects has been argued to provide the following advantages:

- Bringing about planned change, implementation of strategy and management of complex information systems (Pellegrinelli et al., 2007, Ribbers and Schoo, 2002)
- Aligning, coordinating and managing portfolio of projects to deliver value which would have been impossible had the projects been managed independently (Maylor et al., 2006, Partington et al., 2005)
- Improves the management of projects in isolation, especially in multi-project environment and where projects integration in terms of both development and deliverables is a critical success factor (Pellegrinelli, 1997)
- Provides the approach for dealing with issues such as lack of coordination and control which affect effective and efficient delivery of multiple projects (Lycett et al., 2004).

In summary, research and literature present programme management as the preferred approach when managing multi-projects. There is no universally acceptable framework for programme management but there is agreement in the benefits to be derived if programme management approach is adopted appropriately and not as a scaled-up project management. Furthermore, there is agreement that programme management approach allows for application of key themes such as benefits management; stakeholder management and programme governance to ensure effective multi-project delivery.

The research objective

The research from which this paper emanates investigates how construction contractors manage complex projects in multi-project environments. This paper is based on part of the investigation that sought to explore the management of multi-projects in construction contractor organisations. The aim is to study actual multi-project management from the perspective of the construction industry contractors with a view to grounding and enriching existing theoretical and conceptual frameworks. To be able to carry out the research, an appropriate methodology is essential. In order to fulfil the aim of the study, a multiple case study approach was adopted for the investigation. This methodology is preferred because: it allows the research investigation to be carried out in context; allows an in-depth understanding of project complexity in a real-life setting; and also allows empirical and in-depth use of different combinations of data collection which were not identified in literature (Yin, 2009). Five organisations with long term experience in managing complex multi-projects were involved in the study which provided access to the projects they were undertaking.

Research design

In order to explore the management of multi-projects in the organisations participating in the research, the questions asked were:

- *How do you manage multi-projects in your organisation?*

- *What management approaches, arrangements, framework and/or practices are employed in managing multiple projects?*

The aim was to obtain data from multiple sources on actual practices on the five construction contractor organisations and create succinct case summaries using a common format to facilitate both in-case and comparative analysis across the five cases. The organisations were private firms based in the UK and providing construction services both on national and international fronts across Europe and Asia. The multi-projects investigated included hospitals, schools, roads, hotels and a wind farm.

The empirical data was collected using semi-structured interviews. An outline interview and data collection protocol was developed summarising key questions and areas of interest for observation or investigation. The intention was to build as comprehensive as possible a picture of the functioning of the participating organisations. In particular, the protocol was designed to find out how those involved in multi-project delivery used multi-project (including programme) management principles and whether they were aware of such principles. The research entailed semi-structured interviews with multiple participants in relation to each multi-project, spanning a period of three to six months.

The participants were practitioners with long experience in managing multi-projects within the construction industry and included chief executives, managing directors, programme directors, project directors and managers, planners, design director, commercial director and human resource manager. In addition, documentary information on specific practices adopted for the projects was analysed. The information gathered included organisational charts, annual reports stating organisations objectives, press releases concerning the projects or an influential area, general public literature describing the organisation and its business, statements of strategy, selected presentations, process descriptions, performance related and monthly reports, schedules, plans and drawings.

The interview sessions were recorded with the permission of the interviewees, transcribed and coded. Interviews were usually between an hour and two. The coding was formed into clusters of contextual areas so that relationships that otherwise would not have been clear was brought out. Actual practices and approaches were identified from the interview transcripts and observation notes and subsequently mapped out against multi-project themes for review. The data was continually linked to existing theory and body of knowledge of programme management, as well as the wider theoretical context of the management of project-based within an organisation as a whole. The initial findings are presented below.

Research findings

This section presents the key research findings of actual practices of construction contractor organisations in relation to existing theoretical literature and body of knowledge on programme management.

Table 1 gives a summary of the findings in relation to benefits management which is considered a key theme essential to programme management. According to literature benefits management is central to programme management in the delivery of benefits. Benefits are achieved through project outputs which builds capabilities and translates into outcomes for the benefit of the organisation (OGC, 2011). Managing benefits includes identifying likely benefits through engagement with stakeholders and establishment of supporting structures and processes to help with the assessment, quantification, impact analysis and assignment of responsibility and accountability.

The table reveals that these critical benefits management determinants are not vigorously pursued by the organisations. The data analysis shows that construction contractors in the main consider managing multi-projects as business-as-usual and therefore do not consider the use of programme or portfolio management to be of any particular benefit to them.

Organisation	Main themes
	Benefits management
Contractor A	• No individual with sole responsibility for benefits management. Benefits measured in terms of profitability.
Contractor B	• Benefits only considered from individual projects perspective and no formal linkages among projects.
Contractor C	• Benefits management not a recognisable theme pursued within organisation, although individual projects are expected to deliver financial benefits.
Contractor D	• No standardized approach to benefits management. Each project is considered on its own merit to deliver best value.
Contractor E	• Expected benefits set out at tender stage and evaluated monthly, comparing forecast values against actual values realised. Benefits are calculated in monetary terms only.

Table 1 – Benefits management in Contractor organisation

Projects are managed as if they stand alone purely for delivery purposes to derive maximum benefits from each and every project, even if the projects are procured as a bundle. According to one case organisation, *"we are much better off actually having our teams focusing on delivering on the one job, than worrying about the complexity of the programme or portfolio".* Another said *"Well to be quiet honest, I think in construction, if people and companies were more focused on individual stand alone projects rather than what the integration brings, they will be more successful".* Stakeholder management requires considering the interest and concerns of stakeholders to ensure successful programme delivery. It involves identifying and assessing stakeholder needs in order to meet their requirements and improve relations (PMI, 2006).

Organisation	Main themes
	Stakeholder and leadership
Contractor A	• Identification of stakeholders carried out and analysed. Structures put in place for dealing with stakeholder issues.
Contractor B	• Formal identification and analysis carried out and responsibility for dealing with stakeholders assigned to programme leader.
Contractor C	• Stakeholders are analysed to understand what they want and approach tailored to meet their needs. Recognition of interdependence of meeting stakeholder requirements and organizational goals are drawn.
Contractor D	• Formal approach for identification, analysis and managing stakeholders' non existent.
Contractor E	• Regular meetings with stakeholders to address concerns and improve relationships. Formal communication lines exist for addressing issues.

Table 2 - Stakeholder management in contractor organisations

The research revealed that the organisations investigated embraced stakeholder management fully and had structures and processes in place for identification and analysis of stakeholders (Table 2). The importance of stakeholder management is understood by these organisations by recognising their interdependence and the need to address their interest and concerns.
The organisational structures, processes and governance are set up for delivering individual projects or programmes in the organisations studied. Moreover, in the case organisations, it was considered essential to organize for projects specific responsibilities and roles for effective management delivery. Organisational structures, procedures and policies (Table 3) were both generic in terms of core processes and procedures and specific structures for meeting varying demands and services.

Organisation	Main themes
Contractor A Contractor B Contractor C Contractor D Contractor E	Programme Governance • Cross project issues are managed at programme level and solutions found to benefit programme rather than any particular project. • Same tools and control are used for individual projects and programme. • Strategic alignment of programme evident. • Organisational processes and procedures for managing programme are the same for all other projects too. No distinction made. • Programme has an executive board that meets monthly to evaluate progress and agree plans for the future.

Table 3 - Programme governance in contractor organisations

The analysis also highlighted the following general observation as important for construction contractor organisations engaged in multi-project management:

- The organisations business strategy must be aligned to the projects they tender and subsequently deliver. This alignment is best achieved at the very early phases
- Organisations investigated considered benefits in terms of their functional effectiveness which can be translated or evaluated in financial terms, although intangible benefits such as stakeholder satisfaction were also essential
- In all organisations, risk management tend to be most essential and central to their businesses.

The study further revealed the following barriers to contractor programme management approach:

- Construction contractors consider project management as business-as-usual. Adopting approaches such as programme or portfolio management are viewed as unnecessary since there are no proven results to back their benefits
- Unlike clients who intentionally package projects in order to derive benefits that would not have been if they had been procured individually, the construction contractors studied believe that they derive better value when projects are delivered individually than when multi-project approach is adopted
- Construction organisations mostly have core processes, procedures and tools for managing all their projects. Such processes also indicate “how we work” and cannot easily be adapted to suit changing environment within the industry.

Finally, it was found that construction contractors only apply selected elements of the key programme management themes when delivering multi-projects. Project management tools and processes were applied in managing multi-projects. The reason for this can be attributed to the fact that single project management philosophy is ingrained in such organisations applied and only scaled-up when managing multi-projects. To overcome these barriers, construction organisations need to accept that there are differences between projects and programmes and applying the same delivery approach will not yield effective results. Programme management standards tend to focus mainly on processes and underplay the context in which construction contractors undertake their business. Incorporating the contractor's environment to demonstrate how benefits will be derived not only for stakeholders but also the contractor organisation will be the right approach to gain acceptance.

CONCLUSIONS

The paper explores the management of multi-projects in construction contractor organisations. It describes the essential themes of programme management as benefits management, stakeholder management and programme governance. By employing case study approach, the study uses empirical data from five construction contractor organisations to demonstrate that contrary to the view that multi-project management should be applied in a multi-project environment, construction contractors still apply single project management approach to deliver multi-projects. The study found that contractors only apply certain elements of the key themes for programme management in delivering multi-projects.

It also found that including context in multi-project management which recognises the construction contractor's environment will help its acceptance and use. It will also be possible to demonstrate the benefits to be derived in applying programme management approach to managing multi-projects. This in turn will shift the focus from how best to deliver single projects as if they stand alone to how effectively and efficiently multi-projects can be managed to derive benefits.

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FACTORS INFLUENCING ENTREPRENEURIAL INTENTIONS OF BUILT ENVIRONMENT STUDENTS IN SOUTH-WEST NIGERIA.

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ABSTRACT

Entrepreneurs from any field of endeavour are boosters of a nation's economy. Built environment professionals play a vital role in the socio-economic development of a country. This study seeks to identify the major factor influencing the entrepreneurial intention of built environment students in south-west, Nigeria. Random sampling technique was adopted to select 210 built environment students from two universities in south-west, Nigeria. The students were of the building, quantity surveying, architecture and estate management programmes. The students responded to a 15-item questionnaire. Descriptive and inferential statistics were used to analyse the data collected. The findings revealed that perceived behavioural control has the greatest influence on entrepreneurial intention of built environment students. The study concludes that more skill and knowledge of entrepreneurship would boost perceived behavioural control of students towards entrepreneurial activities. Therefore, institutions of higher learning should incorporate more entrepreneurship studies in their curriculum so that most students can have a positive perception and intention towards entrepreneurship. Also the government should provide counselling services and financial incentives to graduates who are interested in entrepreneurship.

Keywords: built environment, entrepreneurial intent, entrepreneurs, nigeria, students.

INTRODUCTION

Construction activities are an index of the economic and social progress of a country (Ogunlana, et al. 2003). In order to achieve economic and social progress Nigeria will require more houses for living; hospitals and health centers for health care services; schools, colleges, polytechnics and universities for education; banks, shopping malls, factories, civil buildings; clubs, theatres and cinemas for recreation; churches and mosques for worship (Bala 2011). The design and construction of these facilities is the responsibility of built environment professionals (consultants and builders).

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Entrepreneurs from any field of endeavour are boosters of the economy. They play a more vital role in developing countries because they create jobs, increase productivity, spur innovation and grow the economy (Ogundele 2007; Omeje 2008).

The Nigerian government has among other mandates to create five million jobs annually within the next three years, establish more skills acquisition centers and implement the local content policy in all sectors, in order to boost job creation in the country. The existing educational system in Nigeria can influence the development of entrepreneurial skills. This is because the academic context is an important environment that impact's on an individual's entrepreneurial tendencies (Franke and Luthje 2004).

However, in times past entrepreneurship was considered a subject for students with a predominantly business background more than any other. Nowadays, the subject of entrepreneurship is gaining much ground even among other disciplines with non-business background (Edwards, et al. 2009). This is because all students have and can develop a set of skills that can make them suitable for creating jobs for themselves and others.

Given the vital role of built environment professionals in the socio-economic development of a country and the benefits of entrepreneurs to nation building, this study seeks to identify the major factor influencing the entrepreneurial intention of built environment students in south-west, Nigeria. It also seeks to determine if there are any significant differences between the entrepreneurial intention of built environment students and their demographic statistics namely: gender, programme type and institution type.

THEORETICAL FRAMEWORK

Theories of Entrepreneurship

Cunningham and Lischeron (1991) identified six major schools of thought on entrepreneurship namely: the great person school, the psychological characteristics school, the classical school, the management school, the leadership school and the intrapreneurship school. Proponents of the great person school (Schumpeter 1934; Schultz 1975) are of the opinion that entrepreneurs are born and not made. They believe that entrepreneurs possess certain characteristics such as energy and persistence that differentiate them from non-entrepreneurs. In the psychological characteristics school, proponents like (Gartner 1989) view entrepreneurs as individuals who possess unique values, attitudes and needs, which drive them. This thought also encompasses the theories of entrepreneurial events (Shapero and Sokol 1982) and planned behavior (Ajzen 1991). The entrepreneurial events theory is based on the fact that entrepreneurial intention is influenced by certain situational context like personal characteristics, perceptions, beliefs, values, background and environment. While the theory of planned behavior is based on the belief that actions are preceded by conscious decisions to act in a certain way (Ajzen 1991). Proponents of the classical school such as (Drucker 1985) believe that innovation is the central theme of entrepreneurship. The management school opines that entrepreneurs are persons who organize, own, manage and assume the risk of an economic venture (Cunningham and Lischeron 1991). The leadership school posits that entrepreneurs are leaders who are able to adapt their style to the needs of people (Cunningham and Lischeron 1991). Proponents of the intrapreneurship school (Timmons 1999; Carrier

1996) believe that entrepreneurial skills can be useful in various organizations through the development of independent units to create market and expand services.

Entrepreneurial Intention

Entrepreneurial intention is the state of mind directing a person's attention towards self- employment as opposed to organizational employment (Bird, 1998). It can be used to predict students' involvement in entrepreneurship and why they decide to venture into business (Ariff, et al. 2010). Shapero and Sokol (1982) and Ajzen (1991) both viewed entrepreneurship from a psychological point of view. Shapero and Sokol (1982) advanced the entrepreneurial events theory. They opined that entrepreneurial intention is influenced by certain situational context like personal characteristics, perceptions, beliefs, values, background and environment. While (Ajzen 1991) belief that actions are preceded by conscious decisions to act in a certain way. He advanced the theory of planned behaviour.

This study would be based on the theory of planned behaviour to explain why built environment students intend to venture into business. This is because the theory of planned behaviour is an intention based model (Ajzen 1991) and is used to explain an individual's intention to perform a given behavior (. Arif, et al. 2010). This theory has been used severally in explaining entrepreneurial intention in a number of studies (Kolvereid 1996; Gird and Bagraim 2008 and Arif, et al. 2010).

Ajzen (1991) explained that intentions were a function of attitudes, social pressures and perceived ease or difficulty of performing the behaviour. He proposed three determinants of intention namely: attitude, subjective norms and perceived behavioural control.

Attitude

According to Ajzen (1987) attitude refers to personal desirability to perform a behavior. It is the degree to which a person has a favourable or unfavourable evaluation or appraisal of the behavior in question (Maalu, et al. 2010). Kolvereid (1996) defines attitude towards entrepreneurship as the personal desirability in becoming an entrepreneurs. This means that high expectations and beliefs towards self-employment reflect a favorable attitude towards entrepreneurship (Arif, et al. 2010).

Subjective Norms

Subjective norm refers to a person's perception of the social pressure endearing one to perform or not to perform a particular behaviour (Ajzen 1987). This determinant of intention is influenced not only by broad cultural attitudes toward entrepreneurship, but also the attitudes of particular individuals, groups and networks the person is most influenced by such as family, friends, peers and significant others (Maalu, et al. 2010).

Perceived Behavioral Control

Perceived behavioural control is the perceived ability to execute target behaviour (Ajzen 1987). It is the ease or difficulty of performing the behaviour and it is assumed to reflect past experience, as well as anticipated impediments and obstacles (Maalu, et al. 2010).

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METHODOLOGY

The descriptive survey research design was adopted for this study. The target population for this study consisted of all final year students in higher institutions in south-west Nigeria. There are four states in south-west Nigeria. Two of the states were randomly selected namely: Lagos and Ogun state. From the two states, two higher institutions were also selected randomly; a university in Ogun state and a polytechnic in Lagos state. Two hundred and ten questionnaires were distributed to built environment students of the two institutions. 132 questionnaires were returned; 68 from Covenant University, Ogun state and 64 from Yaba College of technology, Lagos state. The questionnaire which was distributed in January 2012 was divided into two sections. The first section measured factors influencing entrepreneurial intention of students. A likert scale ranging from 1 (strongly disagree) to 5 (strongly disagree) was used to measure attitude towards entrepreneurship, subjective norms and perceived behavioural control. Demographic information of the students was gathered in the second section of the questionnaire. The constructs for attitude, subjective norms and perceived behavioural control were adapted from (Ariff, et al, 2010).

Data Analyses

Both descriptive and inferential statistics were used to analyze the data obtained for this study. Chi-Square independence test was employed to measure significant difference in the entrepreneurial intention of built environment students based on their demographic statistics of (gender, institution type and programme).

Table 1 Response Rate of respondents

Covenant University	Building	Architecture	Estate Management	Quantity Surveying	Total
No. Distributed	30	30	30	-	90
No. Received	21	25	22	-	68
Yaba College of Tech					
No. Distributed	30	30	30	30	120
No. Received	12	22	15	15	64

Two hundred and ten questionnaires were distributed to Building, Architecture, Estate Management and Quantity Surveying students of Covenant University and Yaba College of Technology. Covenant University does not offer Quantity Surveying programme. Of the all the questionnaires distributed sixty – eight students from Covenant University filled and returned the questionnaire and sixty – four students from Yaba College of Technology also filled and returned the questionnaire.

Table 2 Demographic profile of respondents

Variable	Frequency	Percentage
Gender		
Male	76	57.60
Female	56	42.40
Total	132	100
Institution		
University	68	51.50
Polytechnic	64	48.50
Total	132	100

Programme		
Building	33	25.0
Quantity Surveying	15	11.40
Architecture	47	35.60
Estate Management	37	28.00
Total	132	100

Of all the students that participated in the study 76 (57.60%) were male, 56 (42.40%) were female; 68 (51.5%) were from the University, 64 (48.5%) were from the Polytechnic; 33 (25%) were from Building, 15 (11.40%) were from Quantity Surveying, 47 (35.60%) were from Architecture and 37 (28%) were from Estate Management.

Results

Table 3 Entrepreneurial Intention of Built Environment Students

Entrepreneurial intention	Frequency	Percentage
Yes	124	93.90
No	8	6.10
Total	132	100

Table 3 reveals that 93.90% of built environment students have a positive intention towards entrepreneurship while only 6.10% have a negative intention towards entrepreneurship.

Table 4 Timing for Entrepreneurship

Timing for entrepreneurship	Frequency	Percentage
Immediately after graduation	19	15.32
3 years after graduation	39	31.45
5 years after graduation	66	53.23
Total	124	100

From table 4 it can be seen that 53.23% of the students who have positive intention towards entrepreneurship intend to start their own businesses five years after graduation. While 31.45% intend to go into entrepreneurship 3 years after graduation. Only 15.32 % of students with positive intention towards entrepreneurship intend to start their businesses immediately after graduation.

Table 5 Factors affecting entrepreneurial intention of built environment students

Factors	N	Mean	Rank
ATTITUDE			
Compensation	132	3.80	10
Self-realisation	132	4.21	3
Independence	132	4.20	4
Power	132	4.11	6
Challenge	132	4.12	5
SUBJECTIVE NORMS			
Family	132	3.89	9
Friends	132	2.16	14
Colleagues	132	1.89	15
Lecturers	132	3.39	11
Important people	132	2.17	13
PERCEIVED BEHAVIORAL CONTROL			

Confidence	132	3.97	7
Ease	132	4.45	1
Education	132	3.95	8
In control	132	2.44	12
Skills and capabilities	132	4.36	2
Valid N (listwise)	132		

Table 5 reveals the factors influencing students' intention towards entrepreneurship. From the table, perceived ease of carrying out entrepreneurial activities has the greatest influence on students' entrepreneurship intention. Perceived skill and capabilities for entrepreneurship has the 2nd influence on students' entrepreneurship intention. These two factors belong to the perceived behavioural control category indicating that perceived behavioural control has the greatest influence on students' entrepreneurial intention. The table also reveals self-realization, independence and power as the 3rd, 4th and 5th factors respectively influencing students' entrepreneurial intention. These three factors belong to the attitude category. This indicates that attitude towards entrepreneurship intention has the next influence on students' entrepreneurial intention. The last three factors; important people, friends and colleagues belong to the subjective norms category indicating that it (subjective norms) has the least influence on built environment students' entrepreneurship intention.

Table 6 Test for significant difference

Chi-Square test

Variable	Pearson chi-square	df	assymp. Sig
Gender	11.558	1	0.001
Programme	8.142	3	0.043
Institution	0.411	1	0.521

The results in table 6 indicate that there is a significant difference in the entrepreneurial intention of built environment students based on their demographic characteristics of gender ($p=0.001<0.05$) and programme ($p=0.044<0.05$). However, there is no significant difference in the entrepreneurial intention of built environment students based on institution type because $p = 0.523>0.05$. This could imply that the entrepreneurial intention of built environment students is similar irrespective of differences in their institution type.

Discussions

The findings of the study reveal that built environment students in south-west Nigeria have positive entrepreneurial intention. This finding is consistent with the findings of Kiadese (2008) and Ariyibi (2006) who found out that tertiary students in Ogun and Lagos states respectively have high inclination towards entrepreneurship. This may be because venturing into a business sometime after graduation is normal for most fresh graduates because they lack experience (Ariff, et al.2010). Moreover, it was discovered from the study that of all the categories of factors influencing entrepreneurial intentions of built environment students in South-West Nigeria, perceived behavioural control has the greatest influence on students' entrepreneurial intention. This finding is similar to the findings of (Ariff, et al. 2010) who discovered that perceived behavioural control had the strongest influence on entrepreneurial intention of Malay students. The study also revealed that there is no significant difference between students' entrepreneurial intention and institution type. This

finding is congruent with the findings of Chenube, Saidu, Omumu and Omomoyesan (2011) who found out that entrepreneurial inclination of university students in Delta state, Nigeria is similar irrespective of the institution type. The study however, discovered a significant difference in the entrepreneurial intention of built environment students based on gender and programme type.

Conclusion

Considering the role of built environment professionals in the economic and social development of a nation and the benefits entrepreneurship can bring to an economy, the study investigated the factors influencing entrepreneurial intention of built environment students in South- West Nigeria. It was found that built environment students in south-west Nigeria generally have a positive intention towards entrepreneurship and most of them believe that perceived behavioural control has the greatest influence on their entrepreneurial intention. Therefore, institutions of higher learning should incorporate more entrepreneurship studies in their curriculum so that most students can have a positive perception and intention towards entrepreneurship. Also the government should provide counselling services and financial incentives to graduates who are interested in entrepreneurship.

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KNOWLEDGE MANAGEMENT PRACTICES IN CANADIAN HABITAT FOR HUMANITY AFFILIATES

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ABSTRACT

The majority of knowledge management (KM) research in the construction industry has focused efforts on the for-profit sector. This gap is addressed by assessing knowledge management practices (KMPs) in construction non-profit volunteer organisations (CONVOs), specifically investigating Canadian Habitat for Humanity (HFH) affiliates. Preliminary survey results of 27 Canadian HFH CONVOs are presented based on data collected using self-administered questionnaires. Specific objectives of the survey focus on identifying the key performance indicators and critical success factors for KM; identifying various KM tools (IT technologies and non-IT techniques) utilised; and assessing affiliates' knowledge management maturity. A modified general knowledge management maturity model *(G-KMMM)* is used to investigate how these CONVOs manage the knowledge of its essential temporary labour force. Respondents exhibit varying degrees of knowledge management maturity influenced by their organisational size and operational outputs. Survey results are used to identify a focus group for the adoption of KM tools. Through action research principles we aim to determine whether HFH affiliates adopting both IT technologies and non-IT techniques illustrate higher knowledge management maturity compared to non-adopters.

Keywords: habitat for humanity, knowledge management practices, KM tools maturity, survey

INTRODUCTION

The majority of knowledge management (KM) research in the construction industry has focused efforts on the for-profit sector. However, global natural and anthropogenic (human-induced) disasters increasingly affect the built environment in both developed and developing nations and the role of non-profits has never been more vital (Perreira 2011). The provision of shelter solutions by construction non-profit volunteer organisations (CONVOs) has led to hundreds of these unique organisations collaborating with major international alliances such as the United Nations for example. Construction organisations undertake dynamic projects that generate new knowledge for sharing and reuse which is lost as teams disband upon completion of the project (Ribeiro and Ferreira 2010). Volunteers comprise the majority and, in some instances, entire human resources of CONVOs. Therefore the

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experiences and knowledge created by these volunteers (both internal and external to the CONVO) may be lost as high turnover rates contribute to loss of valuable tacit knowledge. Consequently, opportunities to document lessons learned or best practices and improve future processes to enhance performance are jeopardised (Perreira and Rankin 2011). CONVOs lack the requisite processes and practices essential to knowledge management (KM) since they are also compounded by combinations of fragmented collaboration practice; non-standardise; and poor long term strategising. In addition, Robinson *et al.* (2001) lament that those in the construction industry who have a KM strategy are immature and must secure adequate budgets, time, staff and an IT infrastructure to ensure successful implementation (Al-Ghassani *et al.* 2002).

This research focuses on assessing knowledge management practices (KMPs) in Canadian Habitat for Humanity (HFH) affiliates. Action reaserch (Azhar *et al.* 2010) provides the methodological framework to logically investiage KMPs. The paper reports preliminary results of an *on-going* data collection phase. Currently, sixty nine (69) Canadian HFH CONVOs provide shelter solutions to improverished families through partnerships and demand no down payments or mortage interests, only the total cost of construction. Building operations are dependent on funding from generous sponsors; cooperate donors and volunteer labour from thousands of volunteers, both skilled and unskilled. A pilot test of the survey was conducted using four (4) HFH CONVOs in Atlantic Canada before administering a simple random sample survey to collect data from the remaining population of 65 HFH CONVOs. The survey focused on *identifying the key performance indicators (KPIs)* and *critical success factors (CSFs) for KM*; *identifying various KM tools (IT technologies and non-IT techniques) utilised*; and *assessing affiliates' knowledge management maturity*. A modified general knowledge management maturity model (G-KMMM) (Pee and Kankanhalli 2009) is used to assess each HFH CONVO's KM maturity. The results of the survey are particularly relevant not only to management officials in Canadian HFH CONVOs, but also those in academia and industry practitioners interested in the area of KM.

SURVEY METHODOLOGY

Prior to data collection, a CONVO KM assessment framework was established following gaps' identification in previous research literature (Perreira and Rankin 2011). This framework, a combination of the *construction assessment model (Fayek et al. 2008); principles of total quality management (Deming 1998)* and *construction project phases*, identified the critical success factors (CSFs) for KM in CONVOs and also forms the basis for the development of the research survey instruments. Self-administered questionnaires and interview schedules were developed and pilot tested with six Eastern Canadian HFH CONVOs. Four out of the six CONVOs participated and provided insight on their KM practices which aided the revision of the instruments before administering the survey to the remaining CONVOs. *Figure 1* illustrates a survey design flowchart, where action research (Azhar *et al.* 2010) dictates the workflow highlighting the current diagnosing phase of the research.

A combination of qualitative and quantitative methods was used to collect data from 65 Canadian Habitat for Humanity CONVOs, with a response rate of 46% (27) based on the representative sample size of 59. Data presented in this paper was collected during April 2nd to July 25th from three (3) online self-administer questionnaires using Zoomerang (www.zoomerang.com). Questionnaire 1 collects general respondent and company details, while 2 and 3 collect information on CSFs and KM maturity.

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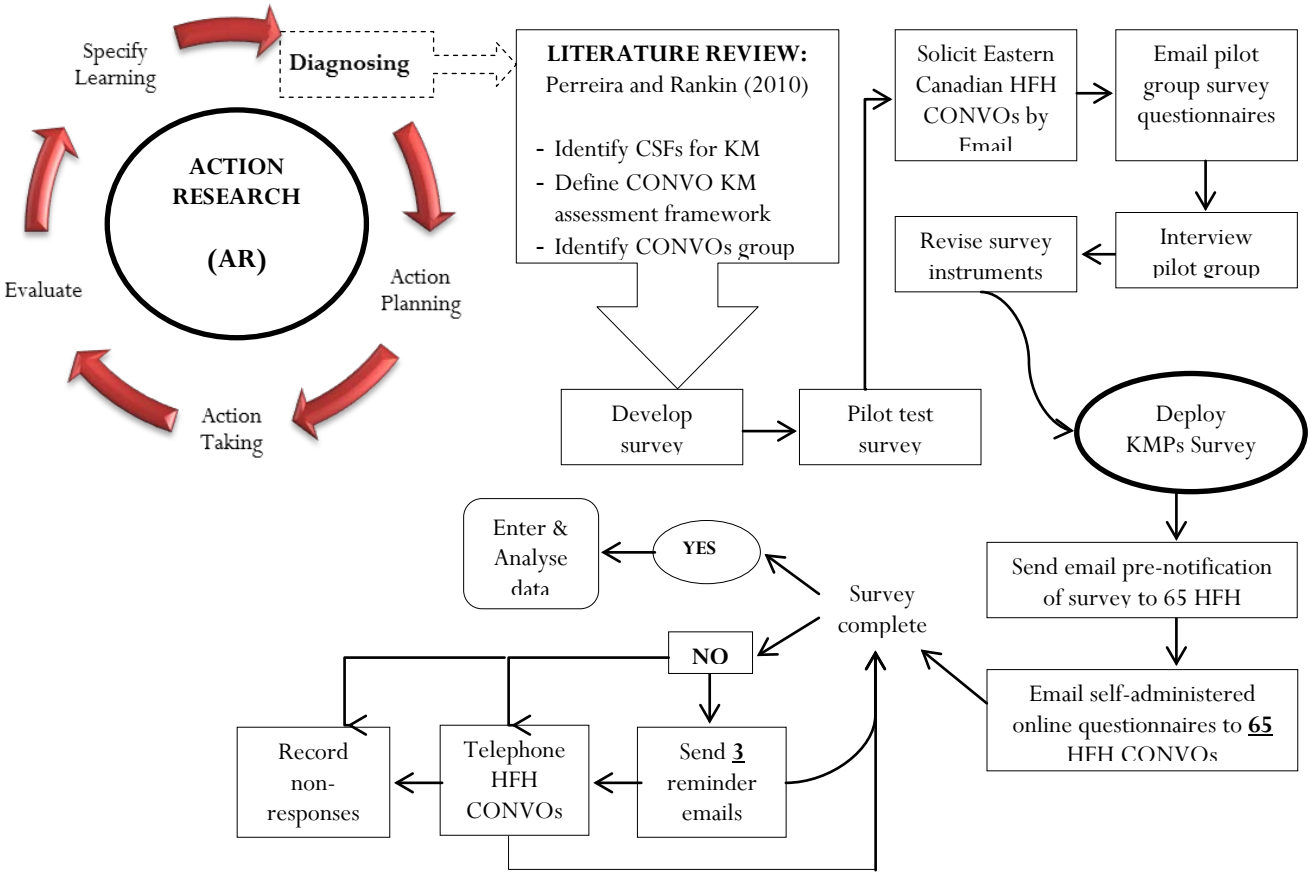

Figure 1: Research survey design flowchart

KMPS IN CANADIAN HFH CONVOS

Table 1, illustrates the company profiles of survey respondents to date classified as large, medium and small urban and regional/rural based on the population centers they serve (HFHC, 2012); average staff and volunteer sizes, age and data on yearly builds. The majority of respondents are company directors. While KM in the construction industry have gained popularity in the United States, Asia, the United Kingdom and other parts of the world, only 42% of Canadian HFH CONVOs survey respondents have heard the term. However 90% agree that both tacit and explicit knowledge are strategic assets to an organisation. Unfortunately, only 19% admit to managing knowledge. In addition, only 74% of respondents have an organisational flowchart yet 48% agree on its effectiveness. Seventy one percent of respondents have no designated knowledge management officer. However, 87% mentioned they have reviewed existing operational manuals to assist their duties but 35% strongly disagreed that dedicated people exist to revise those manuals. Further, only 19% of respondents admit that they regularly compile manuals in the event that they leave the organisation. Figure 2 illustrates how critical the documenting of tacit knowledge is, especially since the level of familiarity of construction aspects varies for project phases. Only 29%, 23% and 32% of respondents are familiar with all aspects pre, during and post construction respectively.

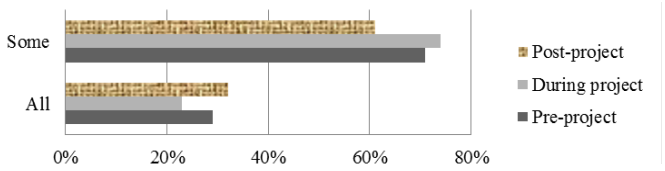

Figure 2: Level of familiarity with construction aspects for each project phase

Table 1: Company profile of survey respondents

Classification	No.	Age (yrs.)	Build Yearly	Position	Staff/yr.	Volunteers/yr.
Large Urban *(541K)*	1	21	Yes	Const. Manager	15-20	> 400
	2	7	Yes	Director	0-5	0-100
	3	9	Sometimes	Director	0-5	> 400
	4	21*	Yes	Director	> 20	> 400
Medium Urban (161–540 K)	5	18	Yes	Director	0-5	200-300
	6	20	Yes	Director	15-20	> 400
	7	19	Yes	Director	5-10	100-200
	8	17	No	Director	0-5	Unsure
	9	12*	Yes	Director	5-10	300-400
	10	24*	Yes	Director	15-20	100-200
	11	18	Sometimes	Director	5-10	0-100
	12	22	Sometimes	Director	5-10	100-200
	13	11*	Sometimes	Director	15-20	> 400
	14	19*	Yes	Director	10-15	> 400
Small Urban *(121-160 K)*	15	25*	Sometimes	Director	10-15	300-400
	16	19	Yes	Director	0-5	0-100
	17	?	No	Finance Manager	0-5	Unsure
Regional/Rural (120 K or less)	18	7*	Yes	Director	0-5	> 400
	19	8*	Yes	Director	0-5	0-100
	20	8	Yes	Director	0-5	0-100
	21	3*	No	Director	0-5	Unsure
	22	13	Yes	Director	0-5	300-400
	23	0.6	No	Director	0-5	0-100
	24	17*	Yes	Director	0-5	0-100
	25	14*	Sometimes	Director	0-5	0-100
	26	17*	Yes	Director	0-5	0-100
	27	9*	Yes	Director	0-5	100-200

'' connotes companies whose year of establishment and attainment of non-profit status differ*

Critical Success Factors for KM in Canadian HFH CONVOs

Perreira and Rankin (2011) identified four major critical success factors for KM in CONVOs: (i) *knowledge processes (e.g. creation/collection, conversions/analysis, transfer/us and revision/store)*; (ii) *KM systems* (e.g. KM tools); (iii) *KM practices (e.g. communities of practices (COPs))*; and (iv) *KM approaches* (e.g. quantitative vs. qualitative) (see Figure 3).

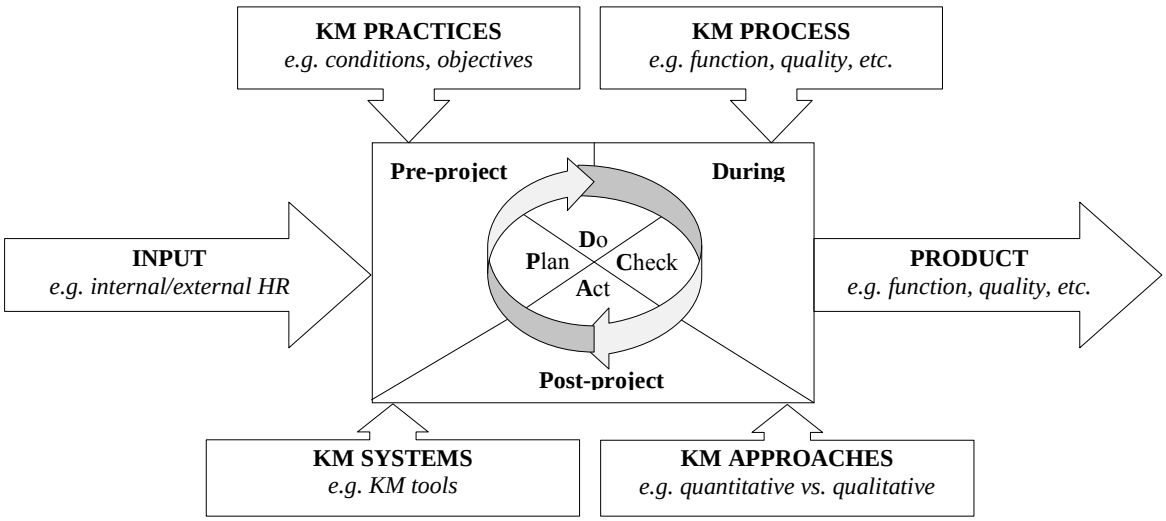

Figure 3: CONVO KM Assessment Framework (adopted from Perreira and Rankin 2011)

Key performance indicators (KPI) were weighted and ranked according to importance. The '*score*' column represents aggregate scores of respondents based on their agreement with KPI statements: *(i.e. strongly agree (5), agree (4), neutral (3), disagree (2) and strongly disagree (1) points).*While the '*impact'* column ranks each KPI based on aggregate perceptions of importance by the respondents. Figure 4 is an example KPI statement:

Please indicate your opinion on the following statements related to PRODUCT TYPE:					
	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
It is important that I am familiar with all aspects of HFH house designs					

Figure 4: Example of KPI question for CSF Product

Table 2 illustrates a comparison between the aggregate weighted scores *(score*) and ranked perceptions *(impact)* of importance of each KPI for practices and product. Comparison in 'practices' for example, suggests the KPI lesson learn programs (LLPs) as the most important. However, the CSF 'product' has some variation amongst its KPIs. For example, quality is perceived as most important when in actuality function/use is weighted as most critical. This validates not only the internal reliability of the survey but may also suggest a dichotomy between what KPIs and CSFs HFH CONVOs perceive as important verses in actuality those which are most critical.

Table 2: Partial comparison of KPIs for CSFs for KM in Canadian HFH CONVOs

RANK	**PRODUCT**		**PRACTICES**	
	Score	***Impact***	***Score***	***Impact***
1	Function/Use	Quality	LLPs	LLPs
2	Quality	Function/Use	COPs	KM Practices
3	Production	Type	KM Practices	COPs
4	Quantity	Production	Blitz	Blitz
5	Type	Quantity		

KM Tools: Usage and effectiveness

A combination of the first author's work experience with HFHs; a pilot test with four Canadian HFH CONVOs; and Egbu and Botterill's (2002) work influenced the creation of a list of KM tools comprising: *IT (information technology) technologies (both hardware and software)* and *non-IT based techniques*. Respondents were asked to indicate the frequency of usage *(i.e. always =5, often =4, sometimes =3, rarely =2, and never = 1)* and for which knowledge process (i.e. knowledge creation, conversion, transfer and storage) each tool was utilised. In addition to usage, respondents were asked to rank the effectiveness *(i.e. highly effective = 5), effective = 4, neutral= 3, some effect =2 and no effect =1)* of the KM tools in all three project phases *(i.e. pre, during and post construction)*. Table 3 presents the mean scores for each KM technology and technique. The most prominent IT tool is Microsoft Office (mostly MS Word, MS Excel and/or MS project) and face-to-face meetings are the preferred choice of the non-IT techniques. Although face-to-face meetings rank second for usage, it is considered most effective compared to emails, smartphones and laptops which are fall close behind. Interestingly, only 32% of respondents report their staff as having excellent computer skills compared to only 6% for external volunteers. HFH Canada uses an extranet called ShareNet to collect and share

information and facilitates monthly meetings inter-organisationally. However many HFH CONVOs express frustration with its interface which may explain the usage and effectiveness of databases in 6th place. In addition, while 61% of all staff has access to computers, daily usage pre, during and post project phases account for 68%, 61% and 61% respectively. Alarmingly, the use and effectiveness of LLPs are ranked 14th for respondents, but 42% said they participate in COPs which ranked 11th. Interestingly, 58%, 68% and 35% of HFH CONVOs said they always collaborate with 'for-profit' organisations pre, during and post project phases respectively, compared to only 19%, 10%, and 13% collaboration with fellow Canadian HFH CONVOs. Therefore, there are potential opportunities to improve Canadian HFH inter-organisational collaboration.

Table 3: Comparison of KM tools usage and effectiveness in Canadian HFH CONVOs

USAGE	RANK		EFFECTIVENESS
Microsoft Tools	**1**	**1**	Face to face meetings
Face to face meetings	**2**	**2**	Email
Email	**3**	**3**	Telephones/smart phones
Desktops	**4**	**4**	Laptops
Laptops	**5**	**5**	Desktops
Databases	**6**	**6**	Databases
Reports/bulletins	**7**	**7**	Microsoft Tools
Telephones/smart phones	**8**	**8**	Internet
Internet	**9**	**9**	Workshops/seminars
Informal networks	**10**	**10**	Reports/bulletins
COPs	**11**	**11**	COPs
Storytelling	**12**	**12**	Storytelling
Workshops/seminars	**13**	**12**	Informal networks
Lesson learned programs	**14**	**14**	Lesson learned programs
Intranet	**15**	**15**	Knowledge maps
Knowledge maps	**16**	**16**	Apprenticeships
Apprenticeships	**17**	**17**	Intranet
Multimedia rooms	**18**	**18**	Multimedia rooms
Multimodal tools	**19**	**19**	Multimodal tools

Canadian HFH CONVOs KMPs maturity

Maturity modelling is adopted to describe the development of any entity over time and can be used as a basis for comparison (Kuriakose *et al.* 2010). These models are necessary to assist organisations embarking on KM which require clear roadmaps or long-term visioning. Maturity models are characterised by various levels which certain key performance indicators must be fulfilled before progression to the next (higher) level is achieved. Kuriakose *et al.* (2010) conducted a morphological analysis of fifteen KM maturity models using dimensions and options comprising: context and applicability (i.e. general, organisational, industry, sector); stages (i.e. 4, 5, 6, 8); assessment (i.e. subjective, objective, unknown); validation methods (i.e. case study, empirical, unknown) and key areas (i.e. general or specific). The general knowledge management maturity model (GKMMM) was selected for this research due to its generic applicability at an organisational context, its 5 stages (i.e. initial, aware, defined, managed and optimised), and its empirical validation of specific KM areas (i.e. people, process and technology). However, a fourth KM area was added to the GKMMM to account for the environmental context which facilitates KM in HFH

CONVOs. The radar chart (figure 5) shows the overall KMP maturity where the highest average maturity level reached is level 3 (defined) by 66% of respondents. Figure 6 illustrates the maturity levels of the HFH CONVOs in each KM area. Knowledge process is the least mature area followed by environment, technology and people with standard deviations of 0.81, 0.75, 0.64 and 0.42 respectively.

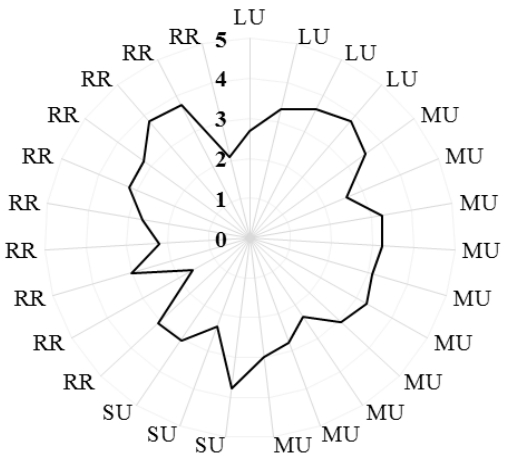

Figure 5: Knowledge Management Maturity of Respondents

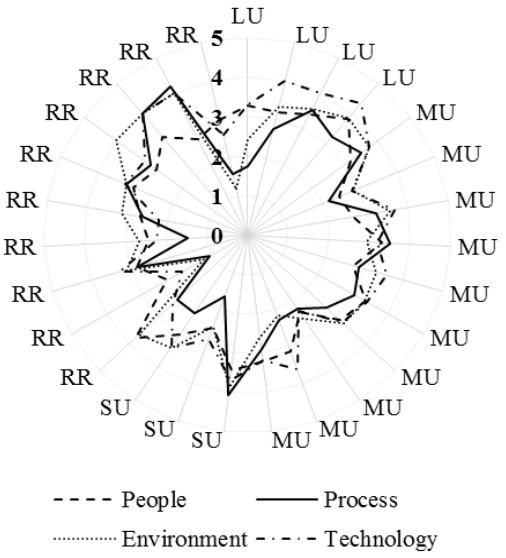

Figure 6: Knowledge Areas Maturity of Respondents

CONCLUSIONS

It is evident from the preliminary results of this *on-going* survey that the CSFs and KPIs Canadian HFH CONVOs perceive as important compared to what in actuality is critical, differ. Although the top five ranked KM tools are *Microsoft office, face-to-face meetings, emails, desktops* and *laptops*, the most effective tools were *face-to-face meetings, emails, telephones/smartphones, laptops* and *desktops*. There is certainly an opportunity to experiment with the use of Interactive communication technologies (ICTs) which can offer virtual face-to-face meetings supported with applications for real time exchange of information. Given the low response rate to date, the empirical results of KM tools usage and effectiveness motivates the researchers to apply supplementary qualitative study to identify barriers and opportunities for KM investment. The maturity analysis illustrates opportunities for improvement since level 3 *(defined)* is the highest level reached by 66% of respondents. This suggests that senior management provides a basic infrastructure for KM through strategies to formally facilitate knowledge processes by experimenting with pilot projects and providing incentives to manage knowledge. Despite this, CONVOs are challenged by limited temporary labour forces and budgets, and the learning curves of staff exposed to new technologies are also barriers to IT adoption. However, inter-organisational as well as 'for-profit' communities of practices collaborations' may offer an opportunity for Canadian HFH CONVOs to invest in KM tools which support improved organisational development.

FUTURE WORK

Subject to completion of the survey by September 2012, future work proceeds to the Action Planning phase of the AR cycle where HFH CONVOs will be contracted for collaboration with the researchers to brainstorm the adoption of KM tools. The objective is to compare the effectiveness of CONVOs who adopt both IT tools and non-IT techniques with ones who adopt only one kind of tool. A small number of HFH CONVOs who have not yet achieved a build may serve as prime candidates as a control group. The researchers intend on action planning by late 2012.

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ON THE ROAD TO IMPROVED SCHEDULING – FITTING ACTIVITIES TO CAPACITY

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ABSTRACT

Last Planner System has through the sounding process increased the reliability of the schedule. The sound activities are moved to a buffer and afterwards selected to the Weekly Work Plans to match capacity. Therefore, in order to maximise productivity it is essential to ensure that the sounding process proceeds in a pace which ensures that enough activities are made ready to the Weekly Work Plans. Experiences from case studies are included. It is observed that site-mangers tend to either include at risk activities or to adjust the manning in order to mach work with capacity. Several different solutions to the problem are suggested and discussed. It is proposed to simplify the production by decreasing the number of trades and tasks completed at site. This can be achieved by increasing prefabrication, preassembly and modularization. If congestions in the making ready process occur buffers should be introduced to absorb the effect. This is achieved by introducing slack at the critical path and supplementing it with buffers of "time" flexible activities.

Keywords: Buffering, Flexibility, Last Planner System, Lean Construction, Scheduling.

INTRODUCTION

Improvement of production processes is often measured through productivity increase. Such statistical measures enable comparative analysis of different production conditions. Construction is often compared to traditional manufacturing, and several studies have provided statistical evidence for construction lacking behind the productivity development of traditional manufacturing (Bertelsen 2004; Winch 1998). This despite recently enhanced focus on improving the productivity of onsite production in construction. Efforts range widely, but this research follows the tail of Ballard (1999) who found that the amount of non-productive time in onsite production amounts to 50% of the total construction time. Thus Ballard's study only addressed non-productive time related to rework and delays. The indication is clear there is a large potential for productivity improvement in onsite construction.

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The Lean Construction philosophy originated in a quest to increase productivity in the construction industry (Liu *et al.* 2011). The first step into developing the lean tool Last Planner System (LPS) was taken when Howell and Ballard through a field study found that only half of the assignments in onsite construction were conducted as scheduled (Ballard 1999; Howell and Ballard 1995).

LPS consists of four main schedules (Cho and Ballard 2011; Salem *et al.* 2005). 1) The Master schedule which cover the entire construction process and establishes overview by including important milestones. 2) The Phase schedule which, between milestones, optimize the sequence of the different phases of the construction project. 3) The Look-ahead plan contains a making ready window from the Master schedule. In the Look-ahead window future activities are made ready for conduction. When ready, the activities are afterwards moved to a buffer of sound activities. Having a buffer of ready work improves the ability to respond to unforeseen events without affecting productivity (Ballard and Howell 1995; Koskela 1992). To ensure that ready work match capacity there should be at least a 14 day buffer of sound activities (Ballard 2000). 4) The Weekly Work plan is a one week plan of containing the activities which will be conducted. The plan is based on mutual commitments between the subcontractors. In the Weekly Work plan, activities are matched to capacity, and only sound activities from the buffer can be signed to the weekly Work plan (Ballard 2000). Securing that only sound activities end up in the Weekly Work plans increases the success rate of completed tasks and stabilizes the workflow (Ballard and Howell 1995). Finally, the quality of the schedule is measured through the PPC measurement. The PPC measurement serves as a feedback- and learning system. If low PPC is measured root causes are investigated and eliminated in order to increase productivity (Lindhard and Wandahl 2012b).

Making activities ready for conduction

Look-ahead planning is the backbone in LPS and it is the key element to ensure reliability in the schedule. Increased reliability is achieved through the making ready process where uncertainties in upcoming activities are sought reduced (Ballard 1999).

Activities are made ready by removing constraints. Traditionally the Lean Construction theory divides the constraints into seven main categories, known as ‘the seven preconditions of construction’. An activity can only be conducted if these seven preconditions are fulfilled (Koskela 1999). Hence, if one of the seven preconditions is not fulfilled the activity cannot be conducted and productivity will decrease. The seven categories of preconditions are:

1. Construction design; correct plans, drafts and specifications are present
2. Components and materials are present
3. Workers are present
4. Equipment and machinery are present
5. Sufficient space so that the task can be executed.
6. Connecting works, previous activities must be completed
7. External conditions must be in order.

Recently research has proposed to split “external conditions” into 3 categories (Lindhard and Wandahl 2012a). Currently the “external conditions” category covers several fundamentally different subcategories. Putting a name on the specific subcategories brings increased awareness and attention to the preconditions. This

helps the site-manager not to overlook any remaining constraints. The "external conditions" category was divided into the following:

7a. Climate conditions must be acceptable. The preconditions focus on external environmental effects such as rain, snow, wind, heat, cold etc.
7b. Safe working conditions must be present. The national "Health and Safety at Work Act" has to be obeyed to keep the employees safe.
7c. The surrounding conditions must be known. The precondition focus on securing that existing conditions, if necessary, are examined. Problems often arise during excavations or refurbishment assignments.

The making ready process is a continuous endeavour. To avoid congestions and to secure a constant flow there is a constant need for ready activities to feed the Weekly Work Plan. If the making ready process is progressing to slow in relation to the schedule the capacity will exceed the ready work resulting in delays and decreased productivity. Construction production is often organized in multiple trades with interacting and overlapping activities which have to be completed in the right sequence (Bertelsen 2003; Salem *et al.* 2006). Therefore, in order to provide the individual trade with sound work the scheduled activities needs to be ready. This makes the making ready process both complex and vulnerable. The complexity in fitting activities to capacity is examined through the following research question:

How can the complexity of the making ready process be decreased in order to fit activities to capacity to create a (continuous and) resistant workflow?

The research aim is to minimize and optimize the handling of misfits between the input from the making ready process and the capacity. The output will be a better workflow which results in increased productivity at site.

RESEARCH METHODOLOGY

Three construction cases were followed in order to observe the making ready process in onsite construction. Here, the focus was to observe arisen problems, their effect on production, and how they were handled.

Some selection criteria were applied in the selection of cases. Firstly, LPS should be used on the case. Phone conversations and mail correspondences with company consultants and site managers were used to ensure this. Secondly, it was a criterion that the contractor, as minimum, was a prime contractor with associating subcontractors. This secured a certain influence to and complexity of the making ready process. These selection criteria were added to increase the validity of the research.

The research was conducted as a qualitative research, where archives, observations, and unstructured interviews were used to collect data from the cases. By using a qualitative approach the making ready process is viewed in its context. The context is important because it affects the process and behavior at the construction site (Hartley 2004). This is supported by Yin (2003) who states that qualitative research is the only approach to answer how and why questions. Data collection from the three cases is listed in Table 1.

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Table 1 Data collection at the three case-studies

	Case 1	**Case 2**	**Case 3**
Contract form	Turnkey contractor	Turnkey contractor	Prime contractor
Site observations	Once every forthnight in total 5 observations.	1-2 times every forthnight in total 8 observations.	1-3 times every forthnight in total 8 observations
Meetings partispated in	Subcontractor, foremen and safety meetings	Subcontractor and LPS meetings	Subcontractor, foremen, emergency and construction meetings
Observation length	10 weeks	10 weeks	10 weeks

EMPERICAL EVIDENCE

First of all it was observed that LPS was implemented differently in all three cases. This in terms of the theoretical correctness and completeness of the scheduling system. In all cases only part of the LPS system were applied. The main observations regarding the application of LPS are summarized in Table 2.

Tabel 2 Application of the making ready mechanisms in LPS.

	General observations
Look-ahead planning	Applied in all three construction cases, but in one case the making ready process had no attention. In one case constraints were dicussed in plenum. Finally, in one case soundness was tracked and constraints were removed using the 7 preconditions as a guideline.
Partisipation in the scheduling process	In two cases subcontractors and formens were directly included in the scheduling process, while in one case the schedule was conducted by management whereafter the subcontractors and formen could make comments.
Making activities ready	Responsibility was delegated to the responsible subcontractor.
The role of Site managment	Site management did not support or guide in the application of the making ready process. Furthermore, the progress and buffer status was not followed
Status of the making ready process	Random problems with the making ready process were observed. Here, scheduled activities could not be conducted because they were not, in time, made ready for conduction.
Responce to variation in the making ready process	A) Adding constraint activities to the Weekly Work Plan to match capacity. This was done with the hope that the constraints would be removed before the conduction started. B) Adjusting the manning of the individual subcontractor to fit capacity to ready work. Changing the manning is expensive it changes the sequence and slows down the production and is therefore a source to delay.

Delegating the making ready progress to the subcontractors entail that the efficiency of the process is left in the hands of the subcontractors. Since site management does not guide or support the subcontractors in the making ready process the likelihood for misusage is increased. If the making ready process is not applied correctly there is no guarantee that only sound activities end up in the Weekly Work plans. Thereby, unreliability has entered the schedule and productivity will decrease.

In all three construction cases congestions emerged between the making ready process and the Weekly Work Plans. The making ready process could not keep pace with the schedule and therefore could not feed the Weekly Work Plans. Even though the making ready process was applied differently there was no noticeable difference in the number of congestions. Moreover, because the making ready was not followed non-completions were difficult to predict and the effect was often unnecessary transmitted to interacting work activities.

Finally, the making ready process is tormented by changing soundness in the ready work activities, due to variation in the fulfilment of the preconditions. Hence it is important to notice that soundness is not a static condition. Varying soundness in ready work can occur in the workable backlog and in activities moved to the Weekly Work Plans. This introduces the risk that an activity in the Weekly Work Plans not is sound on the scheduled time for conduction.

DISCUSSION

From the three case studies it can be concluded that onsite production experience problems with feeding the Weekly Work Plans with ready work. The observations did reveal a tendency only to react after the problem occurs focusing on minimizing the effect. In order to improve the making ready process, root causes needs to be addressed in an attempt to prevent reoccurrences. In the following will different approaches to improve the making ready process will be discussed.

One approach to avoid congestions in the making ready process would be by reducing the number of task conducted at site. Prefabrication, preassembly and modularization are all concepts with that in mind. Simplifying the process is another method to reduce waste (Hopp *et al.* 1990; Koskela 1992). According to Koskela (1992) *"the very complexity of a product or process increases the costs beyond the sum of the costs of individual parts or steps."* By reducing the number of tasks and keeping the production simple the interactions and interdependencies between the subcontractors are decreased. This provides overview and increases the transparency of the process and makes the project easier to schedule.

Simplification can also be achieved by reducing the number of trades working at site. Again the number of interactions and interdependencies between the subcontractors will be reduced. Reducing the number of trades could be achieved by increased prefabrication, preassembly and modularization. Since it is the subcontractors' responsibility to make work ready, the process will now be affected by fewer variables and dependencies reducing the risk and effect of non-ready activities. Ideologically modularization will simplify the assembly process at site leading to less specialized craftsmen. Less specialization equals more flexibility and adaptability in the assembly process. Moreover, less specialization could reduce the number of trades resulting in more work to the remaining subcontractors. The subcontractors are able to faster react on changes and make adjustments, to fit the ready work activities, without just changing the manning. If to specialized the subcontractors are depending on the soundness of a specific activity. Thus with more work on site not ready activities can more easily be replaced by ready work from buffers.

Another approach to avoid congestions in the making ready process is by increasing flexibility of the tasks in the schedule. An increased flexibility loosens the linkages and interdependencies between the subcontractors. Moreover it gives an increased

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productivity, reliability, and it improves the ability to respond on unforeseen events (Ballard and Howell 1995; Koskela 1992).

In general activities in the sequence can be divided into flexible and inflexible work tasks. The free and flexible activities can be used as buffer activities to handle variation without affecting the production. While constraints from the physical relationship between construction components, trade interactions, path interference, and code regulations hinder movement in the inflexible task and tie them to the sequence (Echeverry *et al.* 1991). But even on the critical path slack between activities can be used to absorb small variations. If these variations is not absorbed the productivity will decrease (Tommelein *et al.* 1999).

Another way to increase the flexibility of the production is to increase the flexibility of the workforce. This could be by using multi-skilled crews to make the crews cover a larger variety of work tasks. This way interactions and interdependencies, between crews, could be removed. Furthermore, overtime could be used as a last resort to absorb unexpected delays in activities on the critical path.

Finally, flexibility can be achieved by applying buffers. Since traditional buffering is expensive it is important not to over-buffer but to keep the buffer size adequate and fitting to current uncertainty. If enough work not is made ready the buffered activities will fill up the empty space and keep the production running. This way buffering absorbs variation in the production as well as in the making ready process and increases the robustness of the schedule. If uncertainty and variability is decreased so is the need of buffering. Thus a simplified and more flexible production will reduce the need of buffering.

In addition to traditional buffers where the backlog consists of the following work activities the backlog should be supplemented with flexible activities. These activities can be conducted without regarding the sequencing. Therefore, they have no bindings and can be “stored” until needed. Since preconditions can vary it is important to check-up on the soundness of buffered activities. A weekly “health check” of all activities could be implemented in order to prevent not-sound activities to emerge in the buffer as well as in the Weekly Work Plans.

The ability to convert the production from one task to another is called adaptability. When applying buffers it is important that the switch from the scheduled to the buffered activity is as fast and smooth as possible. By minimizing the time to adapt waste surfacing as non-productive time is removed. In a changing environment such as onsite production where changes is an everyday experience the ability to adapt is crucial. An increased adaptability improves the ability to respond on unforeseen events. This way adaptability is strongly connected to flexibility.

The key rule when avoiding congestions in the making ready process is that activities should always be fit to capacity and not capacity to activities. Therefore, lowing the manning will slow down the production and should therefore only be used as a resort if capacity decreases. To achieve the synergy all the proposed approaches should be used in a combination and fit to the individual construction project.

CONCLUSION

Today changing manning seems to be the solution to handle congestions in the making ready process. Varying the manning is not ideal since it slowdowns the production which result in delays. Ideally problems should be caught at the root. Therefore, in order to avoid congestions in the making ready process it is recommended to focus on simplifying the production by minimizing both tasks and trades at the construction site. Keeping the production simple reduces the number of interactions and interdependencies between the different subcontractors which makes the construction project easier to schedule.

In spite of all precaution error will occur. Therefore, in order to minimize the effect on productivity of such occurrences actions must be taken. Two different approaches are suggested to absorb the variation: increased flexibility and buffering. An increased flexibility loosens the linkages and interdependencies between the subcontractors and improves the ability to respond on unforeseen events. It is suggested to increase flexibility by introducing slack between activities on the critical path. Slack is used to absorb critical variations in productivity.

Moreover it is suggested to use buffers to achieve flexibility in the production. Here traditional inflexible buffer activities in the workable backlog should be supplemented with flexible buffer activities. Flexible buffer activities are activities which not are tied to the schedule. Finally, it is stated that in order to minimize waste more focus is needed on the adaptability to makes this process as efficient and smooth as possible.

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PROJECT MANAGEMENT SERVICE CHALLENGES

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ABSTRACT

The research endeavors to prove that quality services in the construction industry, as opposed to physical products, pose some unique challenges. Services have unique characteristics, such as intangibility, perishability, simultaneity and variability, and these require a specialized approach. The contractor, as service provider, should develop a mind shift not only from profit orientation, but also service orientation. The service provider should place more emphasis on those elements that contribute to the successful completion of a service. The method of research included sending a questionnaire to a group of construction managers and project managers to determine opinions on a quality service and whether services were at an acceptable level of quality. The results showed that the fluctuations in quality of services delivered, difficulty in assessing quality, absence of advice and comparing services and service providers were mentioned as issues between parties involved in a quality-service construction project. These issues can improve service delivery between service providers/contractors and clients. The practical implication is that construction managers should place more emphasis on the quality of strategic elements, such as total customer satisfaction and a high quality-service standard in order to ensure the successful completion of projects in a competitive market environment.

Keywords: construction management, project management, quality, services, strategies.

INTRODUCTION

The purpose of this paper is to illustrate that a project manager has to apply a quality-services approach and need to be more service orientated in order to be able to complete a project successfully within the time and budget available for the project. Profitability as the main aim to ensure a satisfied client is a short-term approach. To ensure long-term profitability, project managers and other professionals should be pro-actively service orientated. This can be achieved by creating long-term relationships, by ensuring expert inputs and dynamic service to clients through communication. Contractor/client satisfaction may result from building good relationships. PMBOK (2008) states quality as the degree to which a set of inherent characteristics fulfills requirements. This implies that the service provided must be of such a standard or quality that it fulfills the client's needs. According to Kotler and Amstrong (1997), a service is an intangible activity or benefit offered by one party to another. Thus, quality service is an intangible activity or a specific standard that fulfills a client's needs and expectations. Managing quality services, project managers need to use strategies to make it possible to complete the project successfully.

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CHARACTERISTICS OF SERVICES

Clients are the reason that the building industry exists. The industry is a service provider. The following are unique characteristics of services implying problems not experienced by physical products. The characteristics are as follows:

Intangible services cannot be seen, tasted, felt, heard or smelled. To reduce uncertainty, a buyer looks for signals of service quality and draws conclusions on the quality of the equipment and communication that they have experienced. Moeller (2010) states that a service is a deed, performance or effort. A project manager therefore has to make the service tangible in one way or another (Kotler and Armstrong 1997; Du Plessis and Rousseau 2003). The project manager will order material and equipment for the project without seeing it and believe the supplier that it will be of a standard that is acceptable for the project.

Perishability indicates that services cannot be stored for later use (Kotler and Armstrong 1997; Du Plessis and Rousseau 2003). Perishability is not a problem when demand is steady, but when demand increases, construction companies need more equipment to handle the demand and try to satisfy clients. Construction companies should design strategies to handle economic fluctuations.

Simultaneity or inseparability indicates that a service cannot be separated from the providers, whether the providers are people or machines. This implies that the services are produced and consumed at the same time (Kotler and Armstrong 1997; Du Plessis and Rousseau 2003). Service providers are often physically present when consumption takes place, while services are first sold, then produced and consumed (Moeller 2010). During the execution phase of the project, the project manager will work with contactors who provide the necessary services without which the project cannot be undertaken. Therefore, the project manager needs so understand how to handle different situations.

Variability or heterogeneity implies that the quality of the service depends on who provides it, as well as when, where and how it is provided (Kotler and Armstrong 1997; Du Plessis and Rousseau 2003). A client will decide on a project manager who consistently provides the best service with every project. The project will depend on a group of stakeholders who all deliver a service and it is the responsibility of the project manager to select a group of people who have the skills, knowledge and personality whom he can rely on to deliver those necessary services when, where and at the standard stipulated by the contract.

The project manager needs to understand the *characteristics* of a service to make it possible to manage a project successfully and of the standard expected by the customer. A client has to be satisfied in three areas, namely the building, the organization or service and the people. Clients are groups of individual people with needs to be satisfied and emotions to be expressed. Buildings are the normal achievement of the industry. Organisations require buildings or services and have an organizational means of financing these requirements (Boyd and Chinyio 2006).

The project manager undertakes the responsibility of understanding the clients and their needs, and how to satisfy these needs, and what influences their decisions, and how they make decisions.

Furthermore, it is important that the project manager knows the difference between the needs and wants of clients. Wants are things that clients can live without, but would like to have. Needs, according to Maslow (in Strydom, Jooste and Cant 2000), seem to be fairly universal for each individual and is something clients cannot live without. Contractors must therefore know what is essential and what the clients' desires are.

SERVICE-ORIENTATED VS A PROFIT-ORIENTATED APPROACH

Meeting customers' needs and wants economically is vital to the survival of any organization or project. This traditional profit-orientated approach has changed over the last few years to a service-orientated approach (Steyn 2003). The primary focus of quality management is total satisfaction of customers within a management environment that seeks continuous improvement of all systems and processes (Pun and Nurse 2010). However, the relationship between clients and the industry is not one of mutual enjoyment. In many cases there is a mutual dislike and distrust. Clients see the industry as a problem and often express this feeling in public. The industry sees the clients as a problem and although the industry may to work for clients, behind closed doors they complain about the clients. Clients need better value from their project and construction companies need reasonable profits in order to assure their long-term future (Boyd and Chinyoi 2006). This implies that construction companies need to shift their focus towards the clients. A customer-orientated approach will ensure their future.

Berry (in Du Plessis and Rousseau 2003) suggests the following quality-service methods for cementing a long-term relationship between contractors and customers/clients:

The design of a core service. A core service typically attempts to satisfy central rather than peripheral market needs and provides the basis on which customer relationships can be established.

Customizing the relationship. Tailor services to meet the specific needs of individual customers. By doing so, there will be no incentive for a customer to start afresh with a new service provider.

Service augmentation. Service augmentation refers to efforts to differentiate the service offering by providing additional benefits, valued by customers and not offered by competitors.. The objective is to encourage customer loyalty.

Relationship pricing. Relationship pricing also attempts, by fostering customer loyalty through incentives, to encourage customers to make use of the full range of services offered by the project manager.

The above quality-service methods help to create loyalty and may be used as elements of strategy to build long-term relationships between the contractor and the client (Congram, in Du Plessis and Rousseau 2003). A relationship is initiated and developed through communication (Boyd and Chinyio 2006).

To become more service orientated, contractors need to understand how clients make decisions. It is suggested that clients make decisions according to their beliefs, norms and values that were formed by influences. These influences are based on their individuality and the environment they grew up and find themselves in.

The influences of a clients' individuality are (Du Plessis and Rousseau 2003):

Needs. Such as physical or emotional requirements.

Motives. Inner states that activates, motivate and direct behavior towards goals. Motives make a person aware of their needs and give them a reason for acting on these needs.

Personality. The combination of unique individual characteristics, which reflects consistent and enduring patterns of behavior. Personality makes an individual act in a specific manner in a specific situation.

Perception. A process by which people select, organize and interpret sensory stimuli into a meaningful and coherent picture.

Learning. Learning reflects changes in the probability of behavior as a result of previous experiences.

Attitudes. This refers enduring systems of positive or negative evaluations, feelings and actions.

The environmental influences that have an impact on clients' service choice may be (Du Plessis and Rousseau 2003):

Cultural influences. These refer to beliefs, norms, values and customs that are learned from the society and lead to common patterns of behavior.

Social influences. These influences refer to communication.

Reference group. A group with whom one identifies in such a way that one tends to use the group as a standard for self-evaluation and as a source of values and goals.

Family influences. These are influences of family members who may in some instances assist with decision-making choices.

Economic demand. These influences refer to potential purchasing power, based on the availability of money, or due to the lack of money or creditworthiness. Price, financial risk and investment opportunities are closely associated with income.

Business and marketing influences. These influences refer to direct contact with clients. These influences can also stem from good or bad experiences in the past.

The influences illustrates that every client should be seen as an individual, knowledge of an individual is important and the understanding of the environment where these individuals live may be a viable approach. Communication can be used in the process to convince clients to make use of a specific quality service.

QUALITY

Quality management refers to the activities that determine quality policies, objectives, and responsibilities. The processes of a quality management system include quality planning, quality assurance and quality control (PMBOK 2008). According to Knipe (2002), quality relates to the characteristics by which an output is assessed by clients or stakeholders. A quality plan describes in detail the quality standards for the project and the quality criteria that are used to determine whether the project is correct (Heldman 2011). Clients evaluate quality on the fact that a service meets their needs at the right time at the right price. The process of quality or the quality management plan is as follows:

Quality planning

Quality planning is the process of identifying the quality of standards to be achieved and the test required to confirm the service of a project is on standard. Quality is planned and built into the project from the conceptual stage and is part of the contract agreement. The quality policy indicates the quality of services that should be rendered and the procedures state how to achieving the quality of services delivery (Steyn 2012; Burke 2010). Project managers need to discuss the level of quality with stakeholders early to ensure that everyone maintains that level of quality for the duration of the project. If the quality level is changed or dropped, the project manager must implement the quality-control and quality-standard process to regain the quality level (Dow and Taylor 2008).

Quality assurance

Quality assurance of services is the process of defining, planning, implementing and reviewing the management process in order to predict with confidence that the required quality of service that will be delivered consistently (Burke 2010). This implies confidence that all the necessary plans, activities and effort will be undertaken to deliver the correct quality of service in order to achieve the successful completion of a project. Quality-assurance activities focus on the process for managing and delivering solutions. The project manager, team members and other stakeholders perform various quality-assurance processes throughout the project (Dow and Taylor 2008). Steyn (2012) states that the quality policy, audits, planning, procedures and work instructions,

and the selection and training of staff are some of the more commonly used tools in the quality-assurance field.

Quality control

Quality control is the process companies go through to confirm that the service has reached the required quality as determined by the specifications in the contract. The quality-control system also defines the methods of inspection and testing (Burke 2010). Steyn (2012) states that the more commonly used quality-control tools are inspection, testing, statistical methods and pareto diagrams which help the project manager to deliver a successful project.

QUALITY STANDARDS

The quality policy contains guidelines rules or characteristics that should be followed regarding quality standards for projects and the policy, (Heldman 2011). The quality standards certify processes and systems of a project, not the service itself. The ISO 9000-1987 is a series of quality standards based on categories, design, production and service delivery (Dow and Taylor 2008). Project managers must try to achieve the ISO 9000 quality standards on projects to improve the service they provide to the customer.

Project managers must determine where in the project quality testing should occur and how the team can improve the quality of the project. The project manager will then determine the focus area for quality testing. The quality management plan implies total satisfaction of the customer at the lowest cost. The success of total quality management mainly depends on the commitment of top management and their willingness to change the quality culture. Construction companies implement total quality management for improving customer satisfaction, obtaining a better quality of products and a higher market share (Isik, Arditi, Dikmen and Birgonul 2009).

MANAGING QUALITY-SERVICE STRATEGIES

Successful service depends on the management of strategies to achieve quality services. Strategies that companies can apply are differentiation and service profit. Service profit means the construction company is paying attention to both the customers and the employees. International service profit can be achieved by the training and motivation of the customer contact employees, external and traditional use of the 4Ps and interactive marketing, which means that service quality, depends on the quality of the interaction between the parties (Kotler and Armstrong 1997). Differentiation means customers want something different from the service than from that of the competitors, and it can be achieved by the design of a superior delivery process that contributes to performance improvement (Walker 2007). Bolton, Grewal and Levy (2007) state that strategies for competing through services are shareholder wealth with profits that flow to the company, managing customers' perceptions of service, customized pricing for quality services, service excellence in the implementation of services, and planning for service recovery by reducing variability in service quality.

Add-ons to these strategies can be commitment and the leadership (Best, Langston and De Valence 2003) of top management to quality services, high-quality standards and communication about concerns and providing feedback (Kotler and Armstrong 1997). Benchmarking may also be used as a strategic tool.

THE RESEARCH METHOD

A questionnaire designed by the University of the Free State consisting of two sections was distributed to thirty-two respondents. Section One consisted of project risk management-related questions and Section Two consisted of project quality management. For the purpose of this article, respondents were requested to indicate their opinions on the questions in Section Two which were analyzed. The response rate

was 100%. The profile of the response rate indicates a reasonable balance between professionals who responded to the questionnaire; architects (9,3%), quantity surveyors (12,5%), engineers (15,6%), construction managers (9,3%), project managers (22,1%) and (37,5%) indicate that they act as project managers and one of the other professions.

FINDINGS

The respondents indicated that a comparison of quality standards with those of the competitors' quality standards is important (81%), whilst benchmarking (41%) is the instrument that most companies use for comparisons. Project managers must make use of the ISO 9000 as a benchmark in comparing themselves with their competitors. Respondents indicated that a comparison between quality standards and the service itself is essential, for service providers, but it does not happen in reality. The respondents' results regarding their company's customer orientation were compared with the literature. Respondents rate customer orientation (87%) considerably higher than profit orientation (13%).

Respondents indicated that for projects they were involved in, they have a quality process in place for planning, audit and control. Quality training was rated fairly important and quality communication and communication about quality equally important. Fluctuations are experienced in the quality of service delivered, although it was difficult to assess quality.

Understanding quality and how the steps to quality may improve the communication network and process, and by doing so, improve communication itself. It is important to apply the steps to quality and value when drawing up a project's planning documentation and during construction.

CONCLUSIONS

The study clearly shows the importance of quality services in the construction industry. Currently a mind shift from profit orientation to service orientation has taking place in the construction industry. Needs are satisfied when a client is fully satisfied with a service and when there is a guarantee that the product or service is of such a quality that it delivers value for money.

The elements that contribute to the successful completion of projects are quality planning, quality assurance, quality control and communication about quality. Communication instruments related to the construction industry and the role construction professionals may play in improving the effectiveness of correct procedures and systems.

An effective tool to build a quality relationship with a client is communication, a strong link between the project manager, the client or professionals, and the construction project. Figure 1 shows the quality communication triangle.

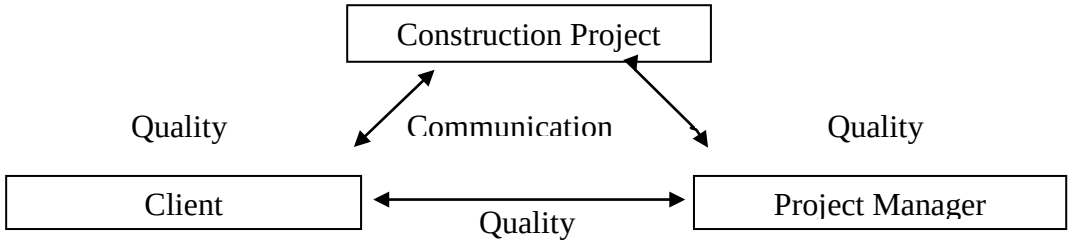

Figure 1: Quality communication triangle

Communication is the element which sells and resells ideas, explains the scope and methodologies of the project, bargains with providers and suppliers, or negotiates to settle disputes or conflict and build a relationship (Steyn 2003).

Clients and contractors should communicate effectively from the planning stage. They should also discuss all the concerns and issues of importance to the project to ensure a sound relationship that will focus on a long-term relationship. Communication, on a

more regular basis, will improve the quality of services and build relationships during the entire life of the project.

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THE CONSTRUCTION PROJECT MANAGER'S PROFILE: A REVIEW OF PROFILE REQUIREMENTS FOR A MATURITY MODEL

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ABSTRACT

Some project managers within the South African construction industry seem to have a lack of sufficient and effective management skills. This study aims to suggest solutions and to propose a model with guidelines for creating a profile for effective construction project management, as well as to determine the characteristics and skills needed by such a professional. Basic management principles, tasks, responsibilities and the behavior of the project manager are studied and the results may form the basis for creating a probable profile for a construction project manager. The methodology used was to do a comprehensive literature study, followed by a structured questionnaire sent to professions involved with a construction project manager such as architects, quantity surveyors, engineers, etc. The findings showed that the areas of management and the functions and responsibilities of the project manager can be regarded as the task of the project manager, while certain skills and characteristics can assist the project manager to perform the necessary management tasks successfully. The profile for a construction project manager is proposed by identifying the task and the resources needed for the successful execution of the task. The practical implication is that project managers in the construction industry should identify and develop the necessary skills to comply with the suggested profile.

Keywords: Built environment, construction project management, competencies, maturity, profile requirements.

INTRODUCTION

Project managers within the construction industry possibly have a lack of sufficient and effective management skills. This study aims to find solutions, and to propose a model with guidelines for creating a profile for effective project management, as well as to determine the characteristics and skills needed by a project manager. Basic management principles, tasks, responsibilities and the behavior of the project manager are researched and these results may form the basis for creating a probable profile for a construction project manager.

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If a profile can be created based on the research, this profile might be used to prepare the project manager for effective management and the successful completion of projects. Construction project managers can be measured by means of this profile and adapted where necessary to meet the requirements. Gaps that are thus identified can be rectified. This profile can form the basis of model proposing to measure the maturity of the profile for construction project managers in construction project management companies. Individuals will also be able to evaluate themselves and to make adjustments, where necessary.

The research shows regular cooperation between project managers in the construction industry and other stakeholders, as well as that poor management by the project manager contributes to project failure. Although management guidelines exist, it is evident that project managers do not implement them effectively. This might have a negative impact on projects. It is important that the project manager has some characteristics and skills to implement management functions successfully. When a construction project is undertaken, the timely identification of tasks, activities, areas of management, functions and responsibilities is important in order for the project manager to be knowledgeable about what is expected.

The areas of management, as well as the functions and responsibilities of the project manager can be regarded as the task of the project manager, while certain skills and characteristics can assist the project manager to perform the necessary management tasks successfully. The profile for a project manager is compiled by identifying the tasks (areas of management, functions and responsibilities) and the resources (skills and characteristics) needed for the successful execution of the task.

Project Management Areas

The areas of management of construction project management might be regarded as an important management guideline for the construction project manager and might therefore contribute to the identification and development of a profile for a construction project manager.

According to the PMBOK (2008), there are nine areas of management, which include: integration management, scope, time, cost, quality, human resource, communication, risk and procurement management. Zack (2004) adds another four areas of management specific to the construction industry, namely claims, financial, environmental, and health and safety management.

Each of these areas of management must be managed successfully by the construction project manager to ensure project success. These specific areas might be regarded as a very important management guideline. It might also be an indication of all the necessary knowledge, management skills and characteristics of the project manager. Skills such as leadership, communication and organizing, together with people skills, might contribute to the successful management of these areas.

Project Management Functions

The contribution of management functions by the construction project manager might be significant for the profile development, because of the relation between management functions and the necessary skills and characteristics of the construction project manager. To perform the management functions effectively and efficiently, the construction project manager must display certain management skills and characteristics. These must be developed and applied effectively. These construction

project management functions might be a clear indication of required characteristics and skills, as will the construction project management areas, functions and responsibilities be an indication of the important and necessary skills and characteristics.

For the purpose of this study the focus will be on the following management functions: planning, organizing, leading, coordinating, human resources, communication, control and decision making.

Responsibilities of the Project Manager

According to Heerkens (2002), the responsibilities of the construction project manager can be divided into four categories. The focus of each responsibility is different, which contributes to the diverse role of the construction project manager. The categories include: responsibilities towards the project, the project team, the organization and the construction project manager.

When these responsibilities are met, it should have a significant impact on project success. The responsibilities of the construction project manager contribute to the development of the profile because, together with the construction project management areas and functions, certain skills and characteristics can be identified, which then lead to the establishment of profile requirements for the construction project manager.

Characteristics such as leadership, people skills and technical skills support the execution of the responsibilities of the manager. It is very important that the project manager realizes and accepts responsibility for the project, the team, his organization and himself. Professional conduct and ethics are also very important.

Skills of the Construction Project Manager

Skills can be identified as the ability to translate knowledge into action that results in desired performance (Schermerhorn 2010). According to Best (2010), the competence and efficiency of the project manager should result in improved project results and limit project costs. Fox and Van der Waldt (2007) argue that the lack of skills on the part of the project manager, the project team and the contractors and/or stakeholders contributes to project failure.

Essential skills include: leadership skills, communication skills, and planning, negotiating, motivating and people skills. It is sometimes necessary that the project manager has a flexible personality in order to adapt to the ever-changing environment. It is also advised that the project manager continuously improves his abilities and skills (Andersen et al. 2004).

Ingason and Jonasson (2009) refer to the International Project Management Association's *The eye of competence*. This model illustrates three areas of competence of the project manager. It includes behavioral competencies, contextual competencies and technical competencies.

When certain management tasks and activities are identified, it is important for the construction project manager to have the necessary skills to execute and manage these tasks and activities successfully. Project management skills and functions go hand in hand, because a management functions cannot successfully be carried out without the necessary skills.

Characteristics of the Construction Project Manager

The investigation of certain characteristics of the project manager is needed for the development of a manager's profile. It will contribute to the identification of the necessary skills and characteristics to apply in certain management areas, functions and responsibilities. Certain characteristics are important to have; it will contribute to overall project success.

Burke and Barron (2007) imply that ethics, integrity and professional conduct are very important for the project manager.

Skills, together with characteristics, are needed to execute and manage areas, functions and responsibilities effectively and efficiently. Project success is dependent on the project manager's skills, characteristics and abilities.

RESEARCH METHODOLOGY

Both qualitative and quantitative research methods were used during this study. It includes a comprehensive literature study, followed by an investigation by means of a structured questionnaire to test the hypothesis. The questionnaire was constructed on the basis of the literature study. The literature review included various aspects of construction project management, but the focus of the research was to determine the profile requirements for the project manager to execute the task of management successfully. To determine these profile requirements the project management areas, project management functions and responsibilities of the project manager were investigated which then lead to the investigation of the contribution of the characteristics and skills of the construction project manager towards this profile.

Questionnaire Construction

The purpose of the questions included in the questionnaire is the following: to group the respondents in the following groups: clients, consultants, contractors and other relevant professions; to determine the qualifications of these respondents; to determine the frequency that these respondents are in a close working relationship with a construction project manager; and to determine the importance and successful application of certain skills.

The validity and reliability of answers are confirmed by the qualification and experience of the respondents. Consultants include architects, engineers and quantity surveyors. Contractors and subcontractors as well as clients who are involved in the construction industry contributed to the survey. Other relevant professions, which also form part of the respondent profile, include property developers, facility managers and academics in the built environment.

Sample

Fifty-five (55) questionnaires were distributed among consultants, contractors, clients and other relevant professions in the construction industry in South Africa. A success rate of 71% was achieved.

Data Analysis

The data were summarized descriptively, using Microsoft® Office Excel® 2007 to generate spreadsheets, tables and figures.

RESEARCH RESULTS AND DISCUSSION

Personal Data and Profile

Respondents include clients (5%), consultants (46%), contractors (21%), other relevant professions within the built environment (23%) and unanswered questions (5%). Eighty-seven percent (87%) of the respondents have a degree that is relevant to the built environment. Five percent (5%) have a diploma, five percent (5%) have alternative, yet relevant qualifications and three percent (3%) of the respondents have matric. Sixty-five percent (65%) of these respondents indicated that they were often or always involved in a close working relationship with a construction project manager on their projects. This is an indication of the necessity of the construction project management profession in the built environment.

Effectiveness of Management

The respondents (66%) indicated that they experience a lack of effective management by the project manager on a regular basis. The fact that the lack of effective management is experienced creates a problem regarding the successful management and completion of projects. This lack of effective management by the project manger might have different causes. Therefore it is important for the project manager to develop and apply the necessary skills and traits to ensure that it is not the cause of nor contribute to project failure. The respondents (84%) also indicated that the lack of effective management had a significant impact on project success. The impact on the project might have significant consequences, such as additional time and cost of the project, quality, and scope could also be affected by the lack of effective management.

Effectiveness of Applied Management Guidelines

The respondents were asked to indicate whether they experienced that construction project management guidelines were not effectively followed and applied by the manager. These guidelines include PMBOK (2000, 2008) and Construction Extension to the PMBOK (2007). These guidelines empower the manager to execute his tasks and activities more successfully. The respondents (72%) indicated that they experienced a lack of project management guidelines being applied by the manager on a regular basis. However, this is very alarming, due to the fact that project success is at stake.

Eighty-seven percent (87%) of the respondents also indicated that the lack of applied management guidelines had a huge negative impact on project success.

Project Management Elements: Importance versus Application

Various important construction project management elements were identified based on the literature study. The respondents were asked to indicate the importance of each, as well as the successful application of each of these important elements.

Through the identification of the various important management elements the profile requirements can be established. Elements such as organizing, planning, leading, coordinating, human resources, communication, control and decision making were identified as the most important management elements. These elements are derived from the thirteen construction project management areas, the project management functions and the responsibilities of the construction project manager. Skills and traits of the manager also contributed to the identification of these elements. The literature study was the basis for this identification.

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From Table 1 it is clear that there are discrepancies between the importance and the successful application of these management elements. It is also clear that some of these management elements are not applied successfully or effectively. This might contribute to project failure. Skills and traits support the execution of these tasks and activities. The current application of construction project management elements is disappointing and clearly indicates areas of development.

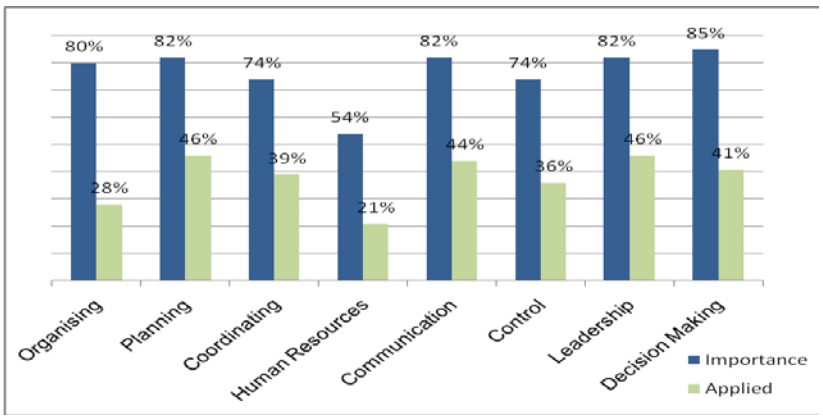

Figure 1: Importance and application of important management elements.

In Figure 1 it is clear that there is no definite correlation between the importance and the successful application of management elements by the project manager. The main focus of this paper is not to compare the importance to the application, but to establish certain development areas. A maturity model can be used to illustrate these areas of development of the identified construction project management elements as mentioned above.

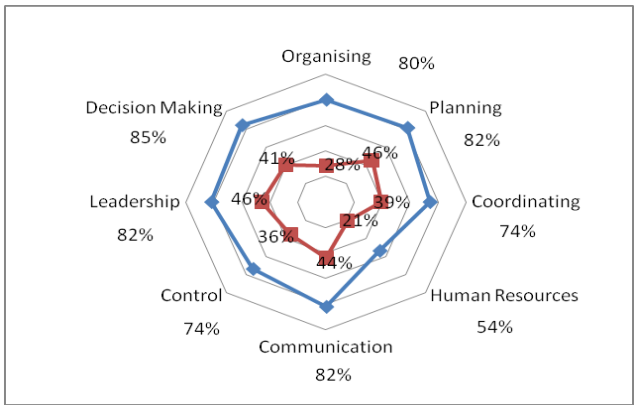

Figure 2: Profile model: Importance and current status

The eight fundamental construction project management elements, now known as profile requirements, are indicated in this maturity model. The importance of each, as well as the current status, is illustrated in this model; thus the areas of development are also clearly identifiable. By using this maturity model construction project, management companies and individuals can measure themselves against this model and make the necessary changes.

CONCLUSION AND RECOMMENDATION

In this study the thirteen areas of construction project management areas, various management functions and key responsibilities of the manager were investigated. These three aspects can be seen as the management task of the construction project manager. To execute this management task the manager needs certain skills and personality traits. This can be regarded as the resources. The investigation of these important construction project management aspects contributed to the identification of fundamental elements of management known as profile requirements.

Based on the data collected, a maturity model was established in terms of profile requirements. This proposed model can be used by construction companies and individuals to measure and determine certain areas of development (relation between importance and application) and make the necessary changes.

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THE EFFECTIVENESS OF CONSTRUCTION CONTINGENCY IN CONTRACT DELIVERY IN NIGERIA

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ABSTRACT

Cost and time overruns are attributable to unforeseen events for which risks and uncertainties were not appropriately estimated by adding an arbitrary percentage allowance for changes that experience shows will likely be required. Contingency is a predetermined amount or percentage of the contract held for unpredictable changes and used to cater for events that are unforeseen which threaten the achievement of objective within the defined project scope. The study determines the percentage contingency on the estimated cost of construction and compares contingency sum with the cost of total approved variation (and fluctuation). In order to achieve these objectives, the research sample selected for this study is quantity surveyors in client and consulting organisations. Data of past projects were received from 21 organisations which include information of 99 projects of varying sizes and contract types. Descriptive statistics was used to describe the characteristics of the sample. Standard deviation, coefficient of variation and analysis of variance (ANOVA) were used for exploring relationships among variables and compare groups. The study revealed that construction contingency averaged 5.53% of the estimated contract sum while variation averaged 11.62%, which means that contingency sum is less than the total approved variation by an average of 6.09%.

Keywords: budget, contingency, percentage, quantity surveyor, variation.

INTRODUCTION

In a construction project and from the client's point of view, contingency is the amount that is set aside to cope with uncertainties during construction. Contracts provide for contingencies to pay for unknown conditions such as price escalation of a product; design changes in scope or due to errors and omissions; or necessary construction changes that are realized on site during construction (Hart, 2007). Touran (2003) posited that it is common to assign contingency value to both cost and schedule because project uncertainties can affect project schedule as well as cost. The ambition of building clients and consultants is to keep the final construction cost within the initial budget estimate that includes a justified additional amount that caters for contingency. In construction and engineering projects plans and cost estimates are

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usually drawn to ensure that the work is carried out to the desired quality, within allowed time, and within budget. According to Baccarini (2004) Contingencies are often calculated as an across-the-board percentage addition on the base estimate, typically derived from intuition, past experience and historical data. Many authors have described this approach as arbitrary and or unscientific including Thompson and Perry (1992), Hartman (2000), Baccarini (2004), Kerlsen and Lereim (2005), (Bello and Odusami, 2008, 2009). Despite the efforts of researchers in developing scientific and statistical methods of estimating and management of contingency, cost experts and practitioners in the construction industry are still glued to the conventional method of lump sum or percentage addition (Bello and Odusami, 2008). Therefore, this study assessed the effectiveness of construction contingency by examining the percentage contingency allowed on the estimate and its comparison with the percentage variation on contract delivery in Nigeria. The findings of this study shall assist the construction practitioners to establish an effective contingency allowance that is applicable in the industry.

Research hypothesis
H1: Contingency sum is less than total approved variation and fluctuation

PREVIOUS WORKS

The major cause of disruption, delay and dispute on construction contracts are changes and risks which are inevitable in construction. According to Risner (2010) no matter how hard architects and engineers try to develop a set of construction drawings that are infallible there are almost always errors or omissions embedded in their drawings. Ashworth (1999) posited that risk can be mathematically predicted, whereas uncertainty cannot. Nworuh and Nwachukwu (2004) asserted that experience on many projects indicate poor performance in terms of achieving time and cost targets hence, many cost and time overruns are attributable to either unforeseen events for which uncertainties were not appropriately estimated. An amount of money used to provide for uncertainties associated with a construction project is referred to as contingency allowance (Mak and Picken, 2000). Patrascu (1988) observed that "contingency is probably the most misunderstood misinterpreted and misapplied word in project execution. Contingency can and does mean different things to different people. Contingencies are crucial to achieving project objectives. Contingency funds are included in development budgets to provide managers with flexibility required to address uncertainties and deviations that threaten achieving objectives. According to Yeo (1990) the objectives of the contingency allocation are to ensure that budget set aside for the project is realistic and sufficient to contain the risk of unforeseen cost increases. Therefore, any realistic contingency must serve as a basis for decision making concerning financial viability of the variations, and a baseline for their control (Akinsola, 1996). Hart, (2007) highly recommended that owners develop an internal process to evaluate project contingency with a process of checks and balances and Risner (2010) suggested a contingency usage form to be completed and signed by both owner and architect as a way to control contingency usage. According to HM Treasury (1993) two major categories of contingency can be identified for construction projects; these are Design and Construction Contingencies. Design Contingency is for changes during the design process for such factors as incomplete scope definition and inaccuracy of estimating methods and data (Clark and Lorenzoni, 1985) while construction contingency is for changes during the construction

(Akinsola, Potts, Ndekugri and Harris (1997); Mak et al (1998); Mak and Picken (2000) and Bacarini, 2005).

Accuracy of construction contingency

The quantity surveyor's or cost engineer's estimate for a construction contract is only intended to predict the bid price of the contract and this must include (an allowance) contingency to account for change order growth or variations. According to Baccarini (2005) a comparison of predicted final cost against actual final cost indicates the accuracy of contingency. Broadly, the smaller the difference between these two costs the more accurate the contingency value. The contingency accuracy is expressed as a percentage of Award Contract value thus,

$$CA = \Sigma V\% - \Sigma C\%$$

Where CA = contingency accuracy, V% = variation% and C = contingency%

$$C\% = \frac{\Sigma C}{\Sigma ACV} \times 100$$

where ACV = Award Contract Value.

Omoregie and Radford (2006) established a minimum percentage escalation cost of projects in Nigeria at about 14% and advocated for an increase in contingency allowance from the present practice to about 15-20%. This is in agreement with Aibinu and Jagboro (2002) and also a percentage allowance recommended by the United States Department of Energy. In Baccarini's (2005) analysis of 48 road projects; the construction contingency averaged 5.24% while the average variation for all projects was 9.92% of ACV respectively. He concluded that the estimation of contingency is not fully reflecting the variability of contract variations – as the contingency accuracy is just, on the average, 52.82% of its actual purpose to cater for variations.

Application of contingency allowance to total estimated cost

Contingency amount set aside varies from project to project (Risner, 2010). According to Rowe (2006) different types of contracts contain different levels of change order risk and initial contingency guidelines should take the contract type into account.

Table 1: Example guidelines for initial contingency assignment.

Contract type	**Initial change order contingency (as a Percentage of Contract Cost)**
Procurement Only	5 per cent
Typical Construction	10 per cent
Special Construction	
Tunnels	15 per cent
Very Small Contracts	20 per cent

Source: Rowe (2006: 32).

Moselhi (1997) posited that contingency estimated with intuition and percentage addition ranges from 1 to 5% and rarely exceeds 10%. Parsons (1999) stated the purpose of contingency allowance is to improve the accuracy of cost estimates by compensating for inherent inaccuracies. This is provided for in form of contingency allowance. This is expressed as:

Total Estimated Cost (TEC) = Estimated Cost + Contingency Allowance.

DATA COLLECTION

The primary data for this study were obtained through structured questionnaire administered to experienced professional and practising quantity surveyors in client and consulting organisations. Purposive sampling was used in selecting respondents. Most of these organisations have projects across the country hence; they are representative of what obtains in the entire population of the study. The secondary data for this study were obtained from records of past projects in the organisations to get cost data variables required for research analysis. A data collection schedule was also used for the generation of cost data of past projects from the organisations. The schedule contains 14 variables extracted from the records of completed projects or on-going projects at completion. Mean Score, Descriptive statistics, Correlation, Regression, and Analysis of Variance (ANOVA) were used for the analysis of data. Inferences drawn were used to make conclusion on the effectiveness of contingency application in construction industry in Nigeria.

RESULTS AND DISCUSSION

A total of 70 copies of the questionnaires were administered to quantity surveyors and or cost expert in three different organisations in the construction sector. Fifty-three of the administered questionnaires were returned, representing 76% percent response rates. Thirty-four percent were from client's organisation while 66% were from consulting firms. The highest academic qualification of respondent is MSc. which constitute 18% of the responses, 47% are BSc. degree holder while the remaining 35% were HND holders. Majority of the respondents are professionally qualified with 60% being corporate members and 8% being fellow members of the Nigerian Institute of Quantity Surveyors. The remaining 32% were probationer members of the institute. This indicates that a large percentage of the respondents have adequate understanding of professional practice.

Estimating percentage contingencies

The research findings revealed that 0-5 percent contingency is mostly applied followed by 5 to 10 percent and application of contingency above10 percent is rare. Table 2 shows the ranking of the means of the common percentage figures employed by the cost experts.

Table 2:T Estimating percentage contingencies

Percentage of Estimate	Mean	Ranking
5%	3.40	1
7.5%	2.92	2
Below 5%	2.79	3
10%	2.64	4
12.5%	1.81	5
15%	1.47	6
20%	1.26	7
Over 20%	1.09	8

The result revealed that 5% is the mostly applied percentage followed by 7.5% and application of percentages below 5%. This confirms that more often than not quantity surveyors applied percentages that are less than 5% of the estimate. The estimation of 10% addition is in the same category with 7.5% and below 5%. The allocation of 20%

and above as contingency is almost nonexistent as their mean scores values are closer to '1' which represent 'never'.

Presentation and Analysis of Project Cost Data

Data were received from 21 organisations and included information relating to 99 projects of varying sizes and contract types. The following information was obtained for each project in the sample: Type of Client (1. Private; 2. Public); Nature of Project (1. New; 2. Refurbishment); Type of Project (1.Residential; 2. Industrial; 3. Health; 4. Educational; 5. Recreational; 6. Religious; 7. Office; 8. Others); Location of the Project; Lowest Bid; Consultant/Client's Estimate; Initial Contract Sum; Amount allowed for Contingency; Final Contract Sum; Planned Project Duration; Final Project Duration; Total Approved Variation; Total Amount of Approved Fluctuation; Gross Floor Area. The first statistical analysis carried out was the use of scatter plot diagram to identify outliers in which four projects were removed from a total of 103 projects which put the total number of projects for analysis to 99. The next step was to check the variability between the projects using analysis of variance (ANOVA) to detect whether the 99 sample size would not violate the assumption of homogeneity of variance and if the 99 projects are statistically significantly different. The variables used were total variation (including fluctuations) on estimated contract value (i.e. less contingency sum) and the contingency sum. The same analysis was carried out on the percentage of the variation on estimate and percentage of contingency on estimated contract value.

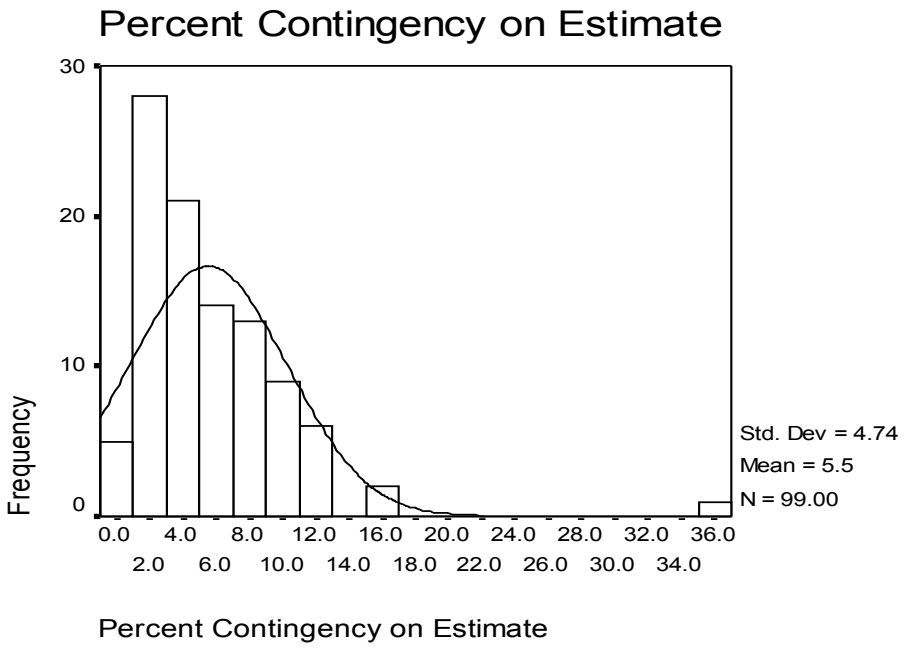

Figure 1: Histogram with Normal curve showing the distribution of Percentage Contingency on Estimate for the ninety-nine project data.

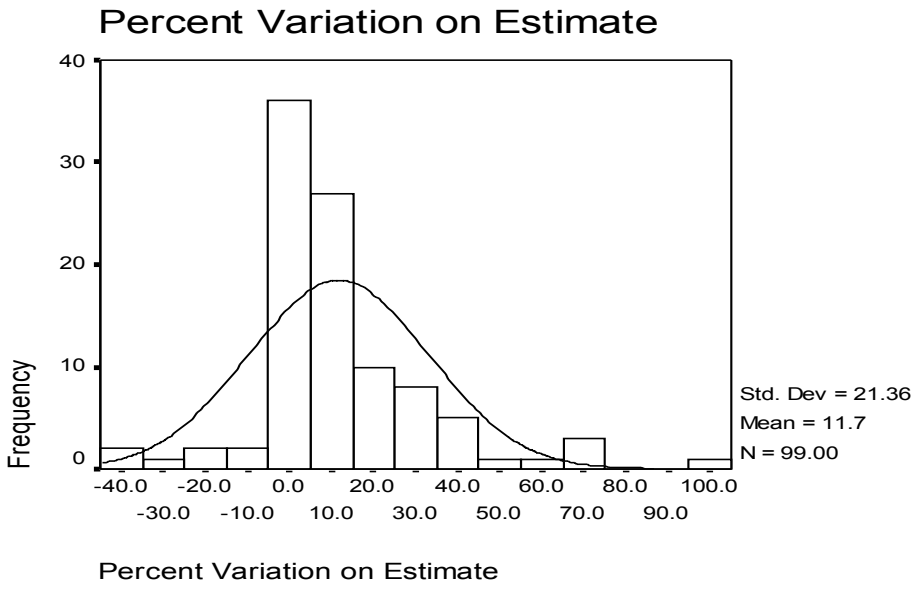

Figure 2: Histogram with Normal curve showing the distribution of Percentage Variation on Estimate for the ninety-nine project data.

The histogram of the line distribution of all the 99 project data of the two percentage variables is illustrated in Figures 1 and 2. A one-way between groups analysis of variance was conducted on the 99 sample projects in which the significant value (Sig.) for Levene's test indicated that the assumption of homogeneity of variance was not violated and the ANOVA table revealed that there is statistical significant difference between the projects.

Comparison of Contingency Sum to the Total Approved Variation

The variables C% for percentage of contingency on net estimated contract sum and V% which is percentage of variation on net estimated contract sum were calculated for each of the projects using Microsoft Excel to form two more variables for the SPSS analysis.

$$\text{Contingency C\%} = \frac{\text{contingency sum}}{\text{estimated contract sum}} \times 100$$

$$\text{Variation V\%} = \frac{\text{total variation}}{\text{estimated contract sum}} \times 100$$

Table 3: mean values of the percentage contingency (C%) and percentage variation (V%) on estimate

	N	Mean	Std. Deviation	Coefficient of Variation
			Statistic	
Percentage contingency on Estimate	99	5.53	4.788	86%
Percentage variation on Estimate	99	11.62	21.390	184%

The C% and V% were generated for the 99 variables and SPSS was used to analyse the descriptive statistics to generate the mean values of the percentage contingency

C% and percentage variation V%. The result of the descriptive statistics is as shown in Table 3.

The result reveals that construction contingency averaged 5.53% of the estimated contract sum and variation averaged 11.62%. To check for the effective accuracy of contingency in percentage: C%/V% x 100 = 47.59%. This indicates that contingency covered only 47.59 percent of approved contract variation and thus, did not cater for 52.41 percent of approved contract variation. The variability of variations (V%) of 184%, as measured by coefficient of variation (from standard deviation and mean), is much greater than the variability of construction contingency (C%) which is 86%. This is a significant difference which was earlier indicated by the ANOVA results. An important observation is that percentage contingency is less than the total variations on the project and it is estimated at about half of its expected value. This result validates the research hypothesis that Contingency sum is less than the total approved variation and fluctuation.

Figures 1and 2 indicated important information which is relevant to the research work. Having discovered the average percentage of contingency and variation on the projects, the range of percentage contingency and variation is analysed. Table 4 sets out the summary of the findings. The analysis revealed that 0-5% contingency is applied for about 58% of projects followed by 5.01% to 10% which covers another 32% of the projects. Contingency of 10.01% to 15% was applied to 7% of the projects.

Table 4: Percentage range of contingency on estimate

Contingency Percentage	No. of Projects	Percent
0 to 5%	57	58
5.01 to 10%	32	32
10.01 to 15%	7	7
15.01 to 20%	2	2
>20%	1	1
Total	99	100

About 15.01- 20% was applied to just 2% of the projects and only 1 (1%) out of 99 projects has a contingency allocation of over 20%.This analysis also strengthens the opinion of the respondents that the most applied percentage contingency ranges between 0 and 5 per cent. This suggests that there is an agreement between analysis of the project cost data and the opinion of the respondents on the range of percentage used in the estimation of contingency.

Table 5: Percentage range of variation on estimate

Variation Percentage	No. of Projects	Percent	Cumulative Percent
> -20%	5	5.1	5.1
-10 to -15%	1	1.0	6.1
-5 to -10%	3	3.0	9.1
-0 to -5%	9	9.1	18.2
0 to 5%	27	27.3	45.5
5 to 10%	19	19.2	64.6
10 to 15%	3	3.0	67.7
15 to 20%	8	8.1	75.8
>20%	24	24.2	100.0
Total	99	100.0	

Invariably, the revelation of the research is validated within the research by comparing respondents opinion and project cost data and, consistently reliable with other research findings. In comparison, the range of the percentage variation on these projects was also calculated so as to ascertain how well the contingency was able to predict the eventual variation on the projects. Table 5 sets out the results of variation (V%) of the 99 projects. It was revealed that in 18 of the 99 projects, the estimated contract sum was reduced by variations (negative variation) and, 36 (9+27) projects have their variations between 0 to ±5%. Thus, in aggregate contingency allowance has been effective in accounting for variation or in avoiding cost overrun in 36% of the projects. An important observation of concern is the number of projects that have variations greater than 20%, 24 projects (24.2%) were in this category.

From the foregoing the accuracy and or effectiveness of contingency can be stated as the difference between the percentage variations and percentage contingency on the projects. That is, 11.62% - 5.53% (from Table 3) which gives 6.09%, a result that is even higher than the percentage contingency. Hence, contingency sum is less than the total approved variation. The research also validates the general opinion that contingency is less than total approved variation in a contract as construction contingency averaged 5.53% of the estimated contract sum and variation averaged 11.62%. This indicates that contingency covered only 47.59 percent of approved contract variation and thus, did not cater for 52.41 percent of approved contract variation. Interestingly, the reverse seems to be the case for road projects as Baccarini (2004) reported that contingency covers 52.82% of approved contract variation but did not cater for 47.18%. He also reported that construction contingency averaged 5.24% while the average variation for the projects was 9.92% of actual contract value respectively. Omoregie and Radford (2006) established a minimum percentage escalation cost of projects in Nigeria at about 14 percent, a slightly higher figure than 11.62% average revealed by this study.

Test of hypothesis

H1: Contingency sum is less than the total approved variation and fluctuation.

The analysis in Table 3 and preceding discussions indicated difference in contingency sum and total approved variation. The stated hypothesis is confirmed and accepted that contingency sum is less than the total approved variation by 6.09% but how significant. A One-way ANOVA with post hoc test was carried out to establish if there is a significant difference between contingency and the variations (including fluctuations). By this the research establishes the effectiveness of contingency on project delivery, if the difference found is significant.

A one-way between group analysis of variance was conducted to explore the effectiveness of contingency on variation, as applied to all the 99 projects in the study. There was a statistically significant difference at the $p < 0.001$ in the two variables [F(42, 56)=6.02, p=0.01]. The effect size calculated using eta squared was 0.82 which indicated a very large effect. The summary of the results is displayed in Table 6.

ANOVA

Table 6: Statistical difference between total variation and contingency

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	526208.063	42	12528.763	6.021	.000
Within Groups	116519.603	56	2080.707		

Total	642727.665	98

Significant at $p<0.001$

The result of the analysis indicates that contingency allocated is not producing the result that is intended on project delivery hence, contingency applied on projects is not effective.

CONCLUSIONS AND RECOMMENDATIONS

The study revealed that construction contingency averaged 5.53% of the estimated contract sum and variation averaged 11.62% which means that total approved variation is more than the contingency sum allowed by about 6.09%. Statistical result of the analysis indicated that contingency allocated is not producing the result that is intended on project delivery hence, contingency applied on projects is not effective. This is a problem to be solved in order to accurately forecast the final cost of any contract at any given time. The importance of forecasting an accurate and effective construction contingency is sine qua non to client's satisfaction on the estimated final construction cost and hence, the construction contract delivery. Contingency sum should be understood as the fund for the client or project manager's authority hence, quantity surveyors should not entertain any fear forecasting. This study recommends a percentage contingency allowance of about 12% to cater for variations on contract delivery. The notion that whether or not there is enough contingency, variation would arise should be discarded. A more proactive and scientific estimating and managing a defendable and reliable contingency that records a reasonable savings at completion of the project should be embraced.

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THE NEED FOR PROFESSIONAL PROJECT MANAGERS IN THE CONSTRUCTION INDUSTRY IN SWAZILAND

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ABSTRACT

The construction industry is one of the most significant contributors to Swaziland's GDP. Traditionally civil engineers, architects and quantity surveyors have assumed leadership in the design and supervision of projects but with the advent of project management as a profession the shift to having a project manager as a specialist independent consultant has not been fully embraced nor appreciated in the construction industry. Most professionals still double as designer and project manager even though a majority of these professionals lack basic training in project management. This paper assesses if there is a need for project management to be formally established as a profession in the construction industry in Swaziland. The current performance levels of professionals working as project managers were investigated. Information was also gathered on the type of qualification of professionals involved in the project management of construction projects. The paper assessed stakeholders' perception in terms of the need for qualified project managers to be involved in major construction projects. Questionnaires were utilised to collect primary data from respondents (project management consultants, municipalities and the Ministry of Public Works and Transport and private sector stakeholders). The findings of the research showed that the current performance levels and qualifications of project managers are not satisfactory. It was found that a need exist to establish project management formally as a profession in the construction industry.

Keywords**:** Project management, professional registration, Swaziland.

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INTRODUCTION

According to the Facilities Management Institute (2005) in the next ten years, the following factors will influence the construction market: customer sophistication, construction skills, construction services, globalisation, consolidation, construction diversity, capital supply, restoration, governance and technology. This demands highly efficient personnel to adequately address the needs and wants of the clients who too are expecting quality services at lower prices. Beard, Loulakis & Wundram (2001) and Konchar & Sanvido (1998) argue that architects and engineers within the construction industry are faced with newer management challenges in business. Many of these challenges are driven by technology associated with building materials, newer design methodologies, design economies and greater sophistication, along with clients' requirement to receive a low-cost, quickly constructed, high-quality and safe project. Traditionally engineers, quantity surveyors and architects have been expected to perform technical and project management roles during the construction phases. Currently the construction projects being undertaken in Swaziland are becoming bigger and more complex. The Kingdom of Swaziland is a small landlocked country of just over 17,000 square kilometres and is about the same size as Wales with a population of approximately 1.3 million people. This article aims to establish if there is need to formally establish project management as a profession in the construction industry in Swaziland. Due to the fact that no similar studies have been conducted the purpose of this study is to make a preliminary assessment that can be utilised for future studies.

Murphy, Bruce & Dalmar (1974) argues that project management and effective leadership continue to impact the success or failure of a project. As any project's success is generally defined on the basis of time, cost and quality performance we cannot diminish the impact of key individuals on the project's ultimate success.

THE CONSTRUCTION INDUSTRY IN SOUTHERN AFRICA

The Department of Public Works South Africa (2005) states that the majority of Southern African Development Community (SADC) countries, including Swaziland, were former colonies of the British Empire. Hence their construction industries are primarily modelled on the British Construction Industry (BCI). The BCI model is characterised by the so-called 'one-off' approach. This is the traditional approach, characterised by the maximised fragmentation of responsibilities between participants and by sequential intervention of the participants in the different phases of a construction project.

The primary professionals involved in this model:

- Engineers (civil, structural, building services and mechanical);
- Architects (principal and landscape);
- Quantity surveyors;
- Construction managers and
- Construction project managers.

According to Smallwood and Rwelamila (1996) the causes for poor performance in the Southern African construction industry are: inadequate training, lack of management expertise, little worker participation, absence of quality management systems and improvement processes. Consequently, not having project managers

during the construction process can result in the above mentioned problems and others. Angelides (1999) argued that like all other human activities project management has to take place within constraints such as scope, time and costs. These constraints have increased the need for an individual who can coordinate and help co-operate the efforts of all the parties involved in the construction process. Cicmil (1997) argued that success (of projects) requires more than just the proper scheduling and budgeting.

According to Department of Public Works South Africa (2005:33-34) there are many primary impediments, which are being experienced by all SADC construction industries. Some of these are:

- Lack of appropriate construction industry policy (only two countries have policies; these are South Africa and Tanzania).
- Artisan, supervisory and management capacity is diminishing.
- The public sector's inability to manage its procurement function has given rise to delivery bottlenecks, which escalate the cost of development to both industry and public.
- Poor quality of work and low level of productivity.
- Project managers do not have appropriate management structures to balance cost, quality, schedule and utility requirements.
- Costly projects delays due to division between design and construction
- Lack of coordination between built-environment professionals.
- Project documents are often late to arrive on site; they are incomplete and contain large sections of irrelevant material.
- A considerable amount of unacceptable quality work arises due to lack of organisation and coordination between trades, which affect location, accuracy, finish, sequence, damage, etc.
- The architect / engineer appointed by the client are inadequately experienced to cope with the coordination of the design team, to lead the design effort and to coordinate the interface between design and fabrication.

THE CONSTRUCTION INDUSTRY IN SWAZILAND

The construction industry in Swaziland falls under the Ministry of Public Works and Transport which is responsible for construction and maintenance of government buildings, construction and maintenance of public roads, administration of Road and outspan act, planning and regulation of road and transport services. The Ministry's mandate is to ensure the provision and maintenance of a sustainable public infrastructure and regulation of a vibrant construction industry and transport. (Ministry of Public Works and Transport, Swaziland, 2007). The construction industry in Swaziland is one of the vibrant and significant industries and many people are employed in this sector, which has contributed to 6.8% of GDP in 2004/5. (Swaziland year book, 2005)

CONSTRUCTION PROJECT MANAGEMENT

Definition of project management

In order to understand the state of construction project management in Swaziland, one has to first understand what project management is and why it is of importance in the built environment professions.

PMBOK (2004) defines Project Management as "the application of knowledge, skills, tools and techniques to project activities in order to meet or exceed stakeholders' needs and expectations."

Kerzner (2006:4) defined Project Management as the "planning, organising, directing and controlling company resources for a relatively short-term objective that has been established to achieve a specific set of goals and objectives."

From the above definitions it is clear that project management encompasses many variables and is complex in nature yet very essential for the timely completion of projects.

Benefits of Incorporating Project Managers in Projects

Burke (1999:8) states the benefits of a project management approach, obviously follows on from addressing the needs of the project. The project manager is responsible for developing a plan through which the project can be tracked and controlled to ensure the project meets the pre-set objectives. Mullaly (2002) states that the role of a project manager is not only managing, but more importantly managing the boundaries themselves. It is this shift in thinking that defines the project manager as an organisational leader. Even on the smallest project, the potential impact of a project manager is significant. Managed well, and the positive impact on the organisation can be exceptional, while the impact of failed project can be devastating.

RESEARCH METHODOLOGY

Questionnaires were mainly used to collect primary data from respondents (project management consultants, companies and the Ministry of Public Works and Transport). This study utilised both qualitative and quantitative methods. Secondary data sources such as books and journals were also utilised.

Research type

Leedy (1997) describes non-experimental quantitative research as "involving careful descriptions of observed phenomena and or exploring the relationships between different phenomena". Different types included in this broad heading are descriptive survey, longitudinal (developmental), correlational and ex post facto research designs. This study used a non-experimental quantitative research methodology.

Sample selection

The researcher distributed twenty questionnaires. The sample size was deemed sufficient taking into account the total population of Swaziland is approximately 1.3 million people and only a small percentage of people are involved in the construction industry as project managers. Questionnaires were distributed to most consulting firms involved in the construction industry in Swaziland. Eleven questionnaires were received back from the different respondents.

Research limitations, scopes and boundaries

The study only focussed on Swaziland and did not assess the need for professional project management in any of the other SADC countries

FINDINGS AND DISCUSSION

The main problem

The main objective of the study is to determine if there is a need for the establishment of project management as a profession in the construction industry in Swaziland.

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The First Sub-problem & findings

The first sub problem investigated the current level of project management performance in the construction industry in Swaziland.

The findings showed that 86% of the projects exceeded the initial completion date by at least 3 months. A third of those (29%) shows that projects even exceeded initial completion date by a year.

30% of project managers interviewed had full control over the budget while 40% supplied estimates and participated in its distribution and 10% supplied the estimates but did not get involved in the distribution of the budget. 20% neither supplied the estimate nor participated in the distribution of the budget. However, the findings of the research showed that only 50% of the projects were completed within budget.

62.5% of the stakeholders that engaged the services of qualified project managers for their projects were satisfied with their performance and the end product. Given the fact that only 25% of project managers had a formal qualification in project management, one would argue that if stakeholders were to use more qualified project managers, more projects will be finished timeously, within budget and with satisfied stakeholders.

The very high number of cost and time overruns on projects recorded in the findings is a clear indication that serious problems exist in the management of construction projects in Swaziland. There is a dire need for intervention to improve the current situation.

The Second Sub-problem

The Second Sub-problem set out to determine the qualifications and background of the consultants acting as project manager in the construction industry in Swaziland.

75% of consultants that are involved in project management do not have a formal project management qualification. 64% of professionals in the construction industry are not affiliated with any professional regulatory body.

The third sub problem

The third sub-problem tested stakeholder perceptions in terms of the need for qualified project managers in Swaziland.

The response of the stakeholders depicts a mixed picture of their understanding of project management, a project manager and their use of project managers in running their projects. Figure 1 below indicates that 37.5% of stakeholders prefer to use qualified project managers, 37.5% of stakeholders do not insist to use qualified project managers and 25% sometimes use qualified project managers.

Figure 1: Use of Qualified Project Managers by clients

Considering the results it is evident that the use of qualified project managers is not an essential requirement for the success of projects in the mind of the client.

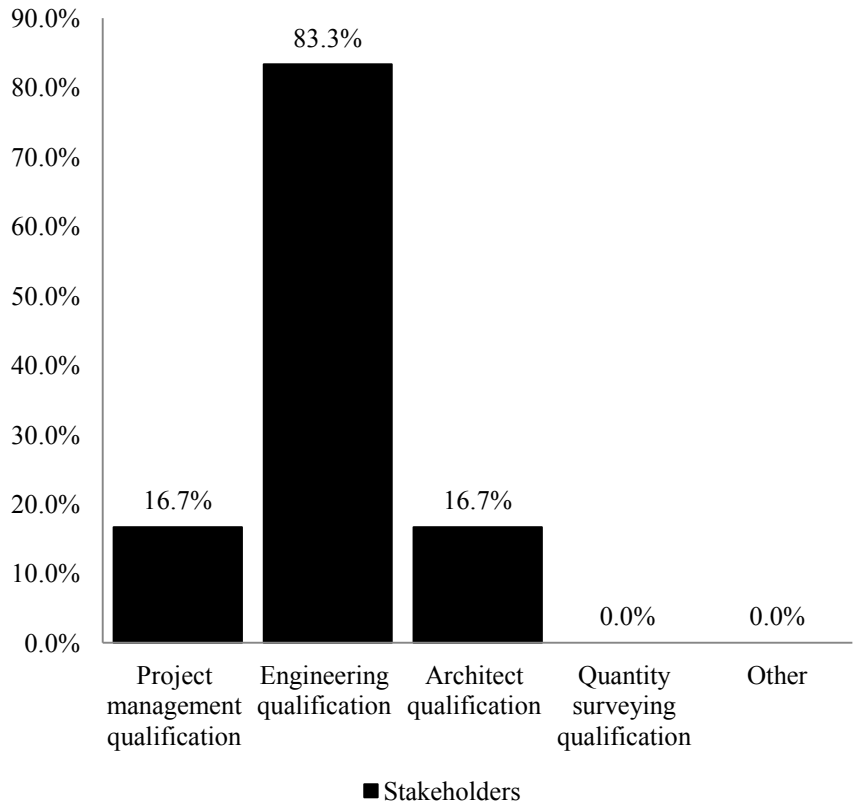

Figure 2: Criteria used in selecting Project Managers

Figure 2 show that most of the people get assigned project management duties by stakeholders by virtue of being professionals who were involved in the design stages of the project.

CONCLUSIONS

The research concluded that performance of project managers in Swaziland is very poor with 86% of projects being completed after the planned completion date and 50% of projects exceeding the original budget. 75% of project managers involved in these projects did not have a formal project management qualification and 64% of professionals involved were not affiliated with any professional regulatory body. The findings also showed that project management is not fully understood as a profession, separate from other fields in the construction industry in Swaziland. It is clear that the establishment of project management as a formal profession in the construction industry in Swaziland will have many benefits. At the very least it will ensure that properly qualified professional would be at the helm of projects resulting in the improvement of project performance.

The following recommendations can be made based on the findings of the research:

- The Ministry of Public Works and Transport should spearhead the establishment of project management formally as a profession.
- There is need for all stakeholders to be educated on the roles and uniqueness of project management and project managers.
- There is also a great need to assess qualifications of project managers and to ensure that the right certification is produced before someone can be declared a project manager.
- Every professional in the construction industry needs to be taught about the role of project managers especially how they are different from other professionals in the industry.

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THE READINESS OF THE WELSH CONSTRUCTION SECTOR FOR MANDATORY BIM

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ABSTRACT

The Construction sector in England is having to come to terms with the requirements of Government legislation aimed at improving its efficiency by 20%. At the heart of this initiative is the requirement for all projects in England to utilise BIM by 2016. The Welsh Government has devolved powers and has a number of social policies which are aimed at developing SMEs and encouraging community gains from construction projects. A seminar for construction professionals was organized by Constructing Excellence Wales to elaborate on the English directive and to consider an example of BIM in use on a Welsh project. This seminar provided the authors with the opportunity to seek the attendees' opinions in relation to their current understanding and use of BIM, their attitude to the English targets and how they thought compulsory BIM might impact on the local supply chain. The results indicate that there is a readiness for implementation in Wales however there is also a concern that its mandatory implementation on public projects could have a negative impact on Welsh companies, in particular SMEs.

Keywords**:** BIM, Community Gains, SME, Wales.

INTRODUCTION TO BUILDING INFORMATION MODELLING (BIM)

BIM involves representing the entire building in the form of a comprehensive 3D model with all the building elements defined parametrically, together with its associated database information (Lo, 2009). (Cerovsek 2011) described BIM as a digital representation of an actual building for project communication over the whole building-project lifecycle. A physical, tangible appearance of a building from a time standpoint can be represented by three model categories: 'as-it-was', 'as-it-is', or 'as-to-be'.

The use of BIM allows for all information provided by other areas of the appointed Construction Team, such as the Electrical and Mechanical elements, Structural elements, the Costs and Management of Materials, and the Fittings and Fixtures used,

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the BIM Model becomes an identical virtual model of what will be built. By making use of the same Model throughout the supply chain reduces the need for duplicating work. There is a large level of risk associated with the duplication of information for convenience sake, mostly because it creates difficulty for the user to discern whether that specific information is in fact the latest available. (Kymmel 2008) insists that information should exist only once rather than be duplicated unnecessarily for convenience of individual access.

The ability to keep information up to date and accessible in an integrated digital environment gives architects, engineers, Contractors, and owners a clear overall vision of their projects, as well as the ability to make better decisions faster (Anon, 2011). This in turn raises the quality and profitability of projects (Van Zyl, 2010). From this information it is possible to conduct a 2D and 3D analysis, allowing the Client and the Design/Construction Team to view the 3D model in its environment, and produce 2D Plans and Elevations to print, along with 3D Still Imagery and Animation. It is also possible to extract 4D Data (Time) from the Model to be analysed in a Software to generate accurate Schedules and Time Simulation of the proposed Building. It is also possible to extract 5D Data (Cost), by using the data within an Estimating Software Package to generate accurate Material Quantities and Costs. Furthermore it is possible to use the BIM model, and variations to the BIM model, to analyse the energy efficiency and sustainability issues of the designs, and through the BIMs abilities to link into Facilities Management software it will further be possible to continuingly use the BIM model Post Hand-over, to maintain the Asset and its Facilities, according to the Manufacturers details, as provided within the model.

Seeing the benefits of BIM, software developers have been producing software that can be 'plugged' into the BIM packages, therefore increasing performance and interoperability with other applications to allow for file transfer and collaboration within the Construction Team. These applications have helped to enhance the performance of the Modelling platform by incorporating functions such as Visual Estimating, Scheduling, Time Simulation and Clash Detection, Energy Analysis, Design and Design Change Analysis.

The capabilities of BIM have also been recognized, and discussed in the UK Government's 'Construction Strategy' Report. Its adoption therefore is being driven by Government departments and large development agencies, including General Services Administration (GSA) (Van Zyl, 2010).

UNITED KINGDOM (UK) GOVERNMENT STANCE ON BIM

The United Kingdom (UK) Government has recently published its Construction Strategy in which it states *There is widespread acknowledgement across Government and within industry – backed by recent studies – that the UK does not get full value from public sector construction; and that it has failed to exploit the potential for public procurement of construction and infrastructure projects to drive growth.*
(Cabinet Office 2011 p3)

The document also challenges the UK construction industry to work more collaboratively, increase innovation in the supply chain and reduce costs by up to 20% by 2015.

The UK construction sector contributes approximately 7% of GDP and is worth about £110 billion per annum which comprises three main sub-sectors: commercial and social, £49 billion (£20bn public, £29bn private); residential, £42 billion (£14bn public, £28bn private); and infrastructure, £18 billion (£7bn public, £11bn private). The industry is highly fragmented, with over 300,000 businesses (of which 99.7% are SMEs) and it employs over 2 million workers. (Cabinet Office 2011)

The document recognises that the UK industry has reduced the fragmentation of the supply chain since the publication of the Latham and Egan reports particularly in relation to long term framework agreements. However it also states that "*there is a tension between the benefits of working with fewer suppliers in long-term relationships, the desire to maintain a market that is accessible to new entrants (particularly SMEs) and the risk of locking out competition and innovation*." (Cabinet Office 2011 p6). This concern regarding the impact on SMEs is supported in the findings of a recent survey which found that 75.5% of SMEs think their size prevents them from winning public sector contracts (Glackin 2012). It also found 94% of contractors believe the government had failed to include SMEs in its procurement system.

Another significant strand of the Government's policy is the requirement for greater use of BIM for the delivery of their construction projects. In 2011, the Government's chief construction adviser, Paul Morrell indicated that BIM is to become compulsory in England for all publicly-procured projects over £50 Million by 2016. Since this announcement the threshold has gradually reduced so that nearly all publicly funded projects in England will be required to utilize BIM by 2016. The mandatory requirement of BIM will be a phased process working closely with industry groups, in order to allow time for industry to prepare for the development of new standards, and for training (Cabinet Office, 2011).

Levels of BIM

The development of a BIM Maturity Model (see Figure 1) illustrates the different levels of within the development of a BIM Process. The current target set by the Government for publicly funded projects is that they must be delivering Level 2 of the model illustrated below.

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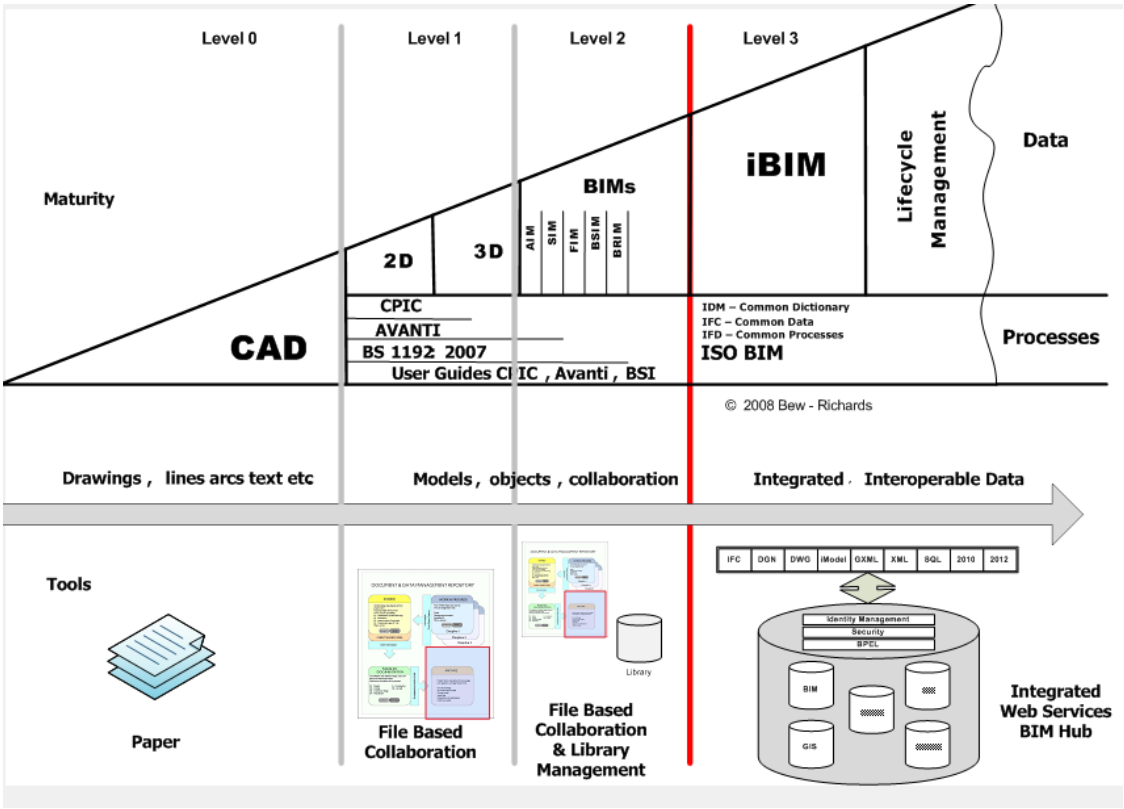

Figure 1 BIM Maturity Levels (BIM 2011 p16)

The first Level: Level 0, represents the traditional methods of developing and printing 2D Plans and Elevations using CAD Software packages such as AutoCAD. Level 1 a managed 2D or 3D CAD environment with a collaborative tool providing a common data environment with a standardized approach to data structure and format. Level 2 where separate BIM Models are created by the different disciplines and merged into one model via compatible software. The final Level: Level 3 represents a wholly collaborative BIM Process where the BIM Model is created and made available via a 'Cloud' so to be used by other Team members so that other industry specific details, such as the structure and mechanical information can be inputted, data is shared through the use of file formats such as IFCs via an Internet Cloud.

The adoption of BIM will call for a profound change in the relationship between public authorities and the construction industry, to ensure the Government consistently gets a good deal, and the country gets the social and economic infrastructure needs for the long-term. The result of this will mean that the public sector will become a better Client - more informed and better co-ordinated when its requirements are specified, designed and procured. The strategy also challenges industry business models and practices. It will replace adversarial cultures with collaborative ones; and will demand cost reduction and innovation within the supply chain to maintain market position – rather than innovation that is focused on the bidding process - with a view to establishing a bargaining position for the future (Cabinet Office 2011).

Van Zyle (2010) believes that BIM is here to stay, and stated that as developers and Government Departments are insisting on the use of BIM to complete new projects, that it will soon be almost impossible to win tenders if you are unable to provide some form of BIM to the Client. Since the acknowledgement of the Government of the

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importance of the use of BIM within the Construction Process it is inevitable, and imperative that this process will soon become widely used throughout the UK, and globally.

GOVERNMENT IN WALES

Since devolution in 1999, many policies and services are different in Wales compared to the rest of the UK. The National Assembly for Wales and the Welsh Government are responsible for most of the issues, including health, education, economic development, culture, the environment and transport.

A comparison of UK, England and Wales construction sectors (see Table 1) indicates the following:

	UK	**England**	**Wales**
Construction firm 1-13 employees	91%	91%	90%
New orders 2010	51% Public 49% Private	50% Public 50% Private	45% Public 55% Private

Table 1 Comparison of UK, England and Wales (UK National Statistics 2012)

The simple statistics indicate that there is a great similarity in the relationship between private and public spending and the number of SMEs delivering that workload.

As part of its devolved powers the Welsh Government has several policies to recognise the importance of SMEs to the economy of Wales. Two examples of these devolved social policies are Opening Doors (Welsh Government 2008), which is a procurement strategy for the public sector in Wales aimed at addressing the concerns of SMEs, and Community Benefits (Welsh Government 2010) which is aimed at providing opportunities for small organisations in Wales, such as SMEs and Third Sector Organisations.

METHODOLOGY

A seminar for construction professionals was organised by Constructing Excellence Wales to elaborate on the English directive and to consider an example of BIM in use on a Welsh project. As part of this study a questionnaire was developed and distributed to attendees of this seminar. The aim of this research was to establish the readiness of the Welsh construction sector to implement the targets for BIM implementation imposed in England. In order to achieve this aim a questionnaire was developed to establish:

1. Current understanding and use of BIM in Wales
2. Attitudes to the targets set for England
3. Perceptions of how BIM might impact on the supply chain.

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Of the 80 attendees 60 completed the questionnaire.

RESULTS

Although the event focused on BIM, 3% (2) of the 60 respondents were still not aware of BIM and a further 62% (37) were Aware and planned to adopt the process in the future. The remaining 33% currently used BIM within their Company.

Of those who currently use BIM, the participants were asked to select for what purpose it was used. The choices provided included: 3D Visualisations (44%, 17), Scheduling (38%, 15), Budgeting (3%, 1), Sequencing (0), Creating a Bill of Quantities (5%, 2) and an 'Other' selection box (10%) which consisted of Research and software distribution.

The participants were asked to consider a range of possible outcomes that BIM might provide. Table 2 shows the percentage of the overall group who selected each outcome. The main positive outcomes selected were "Better collaboration within team", "Clashes detection" and "Greater predictability of time and cost". The main negative outcomes selected included "High cost of hardware and software" and "Uncertainty re legal situation". Only 30% thought that it would "Disadvantage smaller companies".

	Total	Percentage
Better collaboration within team	49	82%
Clash detection	46	77%
Greater predictability of time and cost	44	73%
Increased costs associated with training and updating skills	37	62%
More effective whole life management of properties	36	60%
Reduced waste	35	58%
Faster project delivery	33	55%
Continual improvement	33	55%
High cost of hardware and software	32	53%
Reduction in health and safety risks	30	50%
Better environmental performance/sustainability	29	48%
Uncertainty re legal situation such as liability for errors, ownership of design copyright etc	26	43%
Easier to obtain planning permission for schemes	18	30%
Disadvantages smaller Companies	18	30%
Longer design periods	16	27%
Higher costs to produce project information	13	22%
Other	2	3%

Table 2 What is BIM likely to provide?

In regards to the targets set out by the Government for the implementation of BIM in England, the participants were asked to comment if they believed that Wales should follow the same targets as England. The results indicate that 67% (40) believed that Wales should follow the same targets set out for England. A further 25% (15) agreed with the target but thought that there should be some modification before implementation. The modifications proposed were 11 respondents wanted more time to implement whereas 8 respondents felt that BIM should only be applied to projects over £5 million in value.

As previously discussed, the majority of businesses in Wales are small companies with fewer than 13 employees. The participants were asked to consider the impact of mandatory BIM on the supply chain. The results showed that 52% of respondents thought that "Fewer SMEs would be able to bid for their contracts" and 40% thought that "Fewer local companies would be able to bid for their contracts".

CONCLUSIONS

The United Kingdom (UK) Government has recently published its Construction Strategy in which it challenges UK construction industry to work more collaboratively, increase innovation in the supply chain and reduce costs by up to 20% by 2015. As part of this strategy BIM is set to become compulsory in England for all publicly-procured projects by 2016 at Level 2 maturity. However there is also recognition of the tension that long term collaborative agreements introduce into the Supply Chain relationships, particularly for SMEs.

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Since devolution in 1999, many policies and services are different in Wales compared to the rest of the UK. As part of its devolved powers the Welsh Government has several policies to recognise the importance of SMEs to the economy of Wales. Statistics indicated that there is a great similarity in the relationship between private and public spending and the number of SMEs delivering that workload.

The objectives of this study were to establish:

1. Current understanding and use of BIM in Wales

   The majority of respondents were aware of the BIM process, and just over half already utilized BIM on their projects. The main uses of BIM included: 3D Visualisations (44%, 17) and Scheduling (38%, 15),

2. Attitudes to the targets set for England

   The majority of respondents believed that Wales should follow the same targets set out for England, however a significant minority thought that more time was needed before implementation.

3. Perceptions of how BIM might impact on the supply chain.

   The main positive outcomes selected were “Better collaboration within team”, “Clashes detection” and “Greater predictability of time and cost”.

   However the results also showed that the majority of respondents thought that the mandatory implementation of BIM would result in fewer opportunities for SMEs to bid for work. There was also a significant number of respondents who felt that local companies would be disadvantaged in the bidding process for contracts.

Overall the survey indicates that the existing knowledge and utilisation of BIM within the sample suggests that there is a readiness for implementation. The results also indicate that the Welsh Construction sector is prepared to work to, and deliver the same expectations as those currently imposed in England. However there is a concern that the mandatory implementation could have a negative impact on welsh companies, in particular SMEs which may contradict some of the social agenda policies set by the Welsh Government.

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TOWER CRANE POSITIONING: A 3D SPREADSHEET OPTIMIZATION MODEL

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ABSTRACT

Positioning of tower cranes in construction sites is a crucial yet challenging task in project planning which affects cost, duration, and productivity of projects. Nowadays, although skilful planning engineers carry out this step in site layout planning, they face many problems to achieve the optimum layout design and optimum positions of cranes. This paper aims to develop a decision support system for engineers to help them in selecting the optimum positions for tower cranes in construction sites using Genetic Algorithm (GA). The system input parameters include: site area, construction temporary facilities, buildings locations and heights. In addition, the number, type and range of the available tower cranes as well as their hook velocity and required material loads to be moved horizontally and vertically for each facility are required parameters. The objective is to achieve the minimum crane travel time between temporary construction material warehouses and different construction zones in the site. This minimizes projects construction costs and duration. The output of the model application is the number of tower cranes needed and the proposed position of each tower crane.

Keywords: genetic algorithms, optimization, productivity, site layout, tower crane.

INTRODUCTION

In construction projects, limited spaces are available to build complicated and tall buildings. In addition, construction engineers usually focus on increasing the speed of construction activities to satisfy projects stringent deadlines. It is usually the case that the shorter the project duration, the higher the profits are. In construction of complicated and tall buildings, multiple tower cranes are usually used. As a result, the position of each tower crane needs to be optimized to avoid conflicts in construction site. According to Alkriz and Mangin (2005) site layout planning has a crucial impact on the overall productivity and cost efficiency. Usually, tower crane positioning is carried out by construction managers based on their own experiences using trial/error, without a systematic approach that ensures appropriate crane positioning. Therefore,

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the outcome of site layout may seem to be well organized but not optimized and may lead to increases in cost and waste of labour time and materials.

Rodriguez-Ramos and Francis (1983) handled the problem of positioning a single tower crane hook while waiting to be requested to deal with another load. They developed a mathematical model to reach the exact position of the tower crane to minimize the duration. On 1991, Choi and Harris developed a mathematical model targeting positioning single tower crane where it can minimizes the travel time of the tower crane. Zhang et al. (1996) established a model based on probability to optimise the location of a single tower crane. This model misused the relation between construction zones and the tower crane that consequently affect the optimum position of the tower crane. Leung and Tam (1999) established an Artificial Neural Network (ANN) combined with Multiple Regression Analyses (MRA) model that predicts number of erecting times of the tower crane.

This research introduces a spreadsheet crane-positioning model that optimizes the position of travelling tower cranes and the applicability to be used in the desired construction site. Genetic Algorithm is used to generate potential solutions by applying normal crossover and mutation operators, together with a suitable fitness function to reach the minimum travel time of tower cranes.

An overview of the Genetic Algorithm GA in the construction industry

Genetic Algorithm (GA) was applied to many construction management problems. For example, Genetic Algorithms-based simulation modelling was used to develop a crew allocation system (Al-Abazi, A. and Dawood, N., 2010). They developed a model assisting planners to allocate labours and facilities in construction site so that the project manager could minimize the cost, and consequently increase the profit margin.

In addition, Genetic algorithm was used to find the most beneficial agreement for contractors and suppliers (Dzeng, R. and Yu-Chun, L., 2003). Web-based development was used to improve negotiation efficiency that helps a contractor and suppliers to negotiate via the Internet. This would help both contractors and suppliers in finding good agreement that satisfy their needs.

Problem definition

Due to the complexity of current construction projects and the variety of the facilities in any construction site, planners are facing many challenges to find the optimum site layout and the position of tower cranes to facilitate material and loads transfer among project facilities. The optimization of tower cranes positions became more complicated with rapid technology improvement as travelling tower cranes are being used. As a result, planners started to find a new way to facilitate site layout planning and positioning of tower cranes so that they could reach the desired outcome of using tower cranes with minimum cost and maximum usability.

The main objective of this research is to develop a model that assists planners to find the optimum position of tower cranes by evaluating the weight of each solution and finding a site layout solution that has the highest score. This is achieved by utilizing a set of input data; a fitness function and consequently the output would be the number of tower cranes needed, and the position of each tower crane. This model is illustrated

using a tower cranes design equations where the objective is set to minimize the travel time of all tower cranes. These equations are used to calculate the time for each motion of the cranes that will, consequently, help in calculating the total travel time of the tower crane.

Model description

In this paper, facilities and tower cranes will be assigned by their coordinates. The coordinates will be in Cartesian (x, y) format. All facilities are assumed to be rectangular and the tower cranes will be indicated as circles (plan view) (see Figure 1). The dimensions of facilities will be provided as inputs. The crane type is defined by its radius and the load/radius curve (see Table 1).

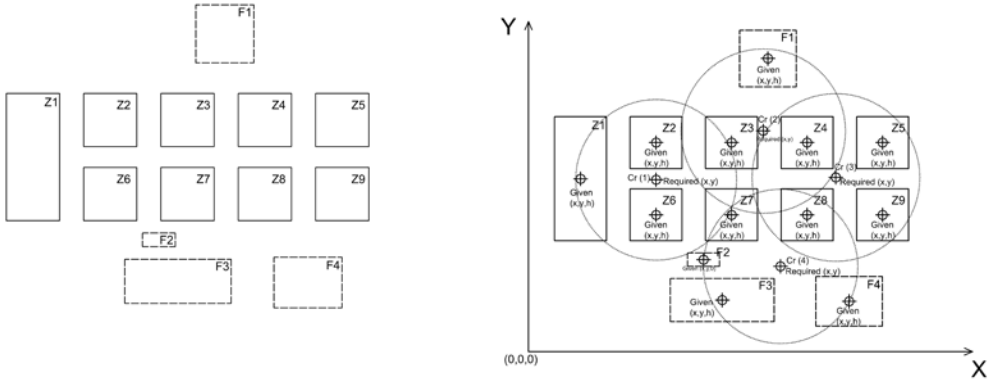

Figure 1- Site Layout and applying Cartesian coordinates

The distance between any facility and the crane should be less than the crane radius. In addition, the load carried from the facility should be less than the load from the radius/load curve. Also, the tower cranes should be placed outside the parameter of the construction site (Zones).

Table 1- Load/radius curve, Alkriz, K. 2005

Radius (m)	1-23	24	25	29	30	33	35	39	40	43	45
Max. Load (Kg)	4000	3815	3630	3030	2910	2590	2400	2100	2030	1860	1750

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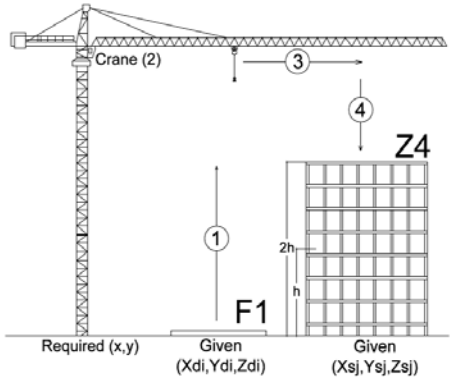

Figure 2 (a)- Transferring material using tower crane (elevation)

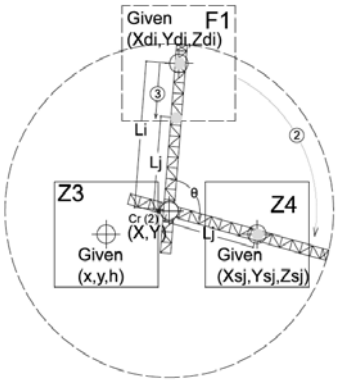

Figure 2 (b)- Transferring material using tower crane (plan)

tower cranes, there are 3 main types of movement. In Figure 2(a), the tower cranes is

Crane 1....

Input Data																						
					Location			Overlap Check					Given Quantities									
No.	Facilities	Width(m)	Area (m2)	Max Loads (unit)	Cx	Cy	h	F1	F2	F3	F4	F5	z1	z2	z3	z4	z5	z6	z7	z8	z9	z10
F1	Concrete Mixer	15	30	2.9	50	50	0	-	0	0	0	0	29	27	27	26	25	27	25	27	24	25
F2	Form work and storage	10	60	3.25	30	40	0		-	0	0	0	1491	442	694	476	413	1020	464	996	446	406
F3	bars yard	15	80	1	50	55	0			-	0	0	215	205	203	194	186	201	188	205	182	183
F4	prefabrication yard	20	40	4	10	20	0	No. of Overlap			-	0	7126	741	7344	7268	7351	7351	6907	741	6097	7126
F5	Crane	5	Required (OUTPUT)--->		35	28	0	0					-	-	-	-	-	-	-	-	-	-
z1	Zone 1 (Formworks)				18	10	16															
z2	Zone 2 (Formworks)				27	5	16															
z3	Zone 3				24	16	16															
z4	Zone 4				30	16	16															
z5	Zone 5				36	10	16															
z6	Zone 6				42	10	16															
z7	Zone 7				48	14	16															
z8	Zone 8				51	5	16															
z9	Zone 9				54	14	16															
z10	Zone 10				60	10	16															
Slewing velocity of crane				0.75	tr/min																	
Crane Trolley Radial velocity				25	m/min																	
Vertical Hoisting Velocity				30	m/min																	
Crane Type (GTA 90)																						
Maximum Length of Crane lcr				45	m																	

Figure 3: Spreadsheet print screen (Input data)

going to pick up the load as a first step then it will rotate around its axis (see Figure 2 (b)), then the operator will move the cart forward or backward till the load is located on top of the desired location (see Figure 2 (a)), and finally he will put down the load (see Figure 2(a)).

As the construction area is fixed, the optimization focuses on the site facilities such as the fabrication yard, batch plant and tower cranes. Many constraints should be considered as follows:

- The distance between the working zone D_j and the facility zone D_i should be less than the crane jib (l_{cr}) or the lifting capacity radius.

$$\text{Max } (D_j, D_i) \leq l_{cr}$$

- Lifting capacity radius should be respected
- No overlapping between any two facilities
- The tower crane operator is not able to make two types of movements at the same time

Input data would be the coordinates of each zone and facilities' center, quantities to be transferred from place to another, the average height of each zone, crane slewing velocity and trolley radial velocity, and length of the crane jip (see Figure 3)

The output will be the optimum Cartesian coordinates of the center of each tower crane that gives the minimum travel time of all tower cranes.

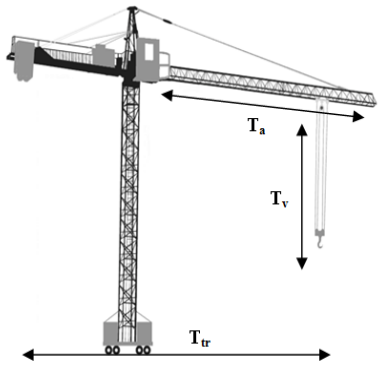

Figure 3- Trolley Radial movement, Vertical movement, and travelling movement

Calculating the hook travel time of cranes

This model is based on calculating the crane hook travel time. To calculate the number of cycles in a task, we need to know total task quantity and the weight that can be handled in one cycle.

No. of crane cycles = Total Quantity (see Table 3) / Max. Handling load (see Table 2)

With the objective of this paper is to determine the location of the tower cranes that would result in minimizing the travel time, the travel time is calculated using simple equations that link the distance, velocity, and time in the horizontal and

vertical plans. The distances can be calculated based on any suggested location for the crane (variable to be determined) and the fixed locations of both zones and facilities. The reader is referenced to figure 2 and Alkriz and Mangin 2005 for basic equations. Firstly, the horizontal travel time should be calculated (Eq. 1 to 4 – Alkriz and Mangin 2005). The horizontal travel time is depending on the hook travel time and the tangential travel time. Once the tower crane operator decides to pick up a load, he has to make two types of movement as a horizontal movement. The first move is trolley radial movement (T_a) (see Figure 3).

– – 1

– – 2

.... 3

..... 4

X, Y: coordinates of the centroid of crane; X_{di}, Y_{di}: coordinates of the centroid of building zone i; X_{sj}, Y_{sj}: coordinates of the centroid of facility j; T_a: time for trolley radial movement; V_a: radial velocity of trolley (m/min).

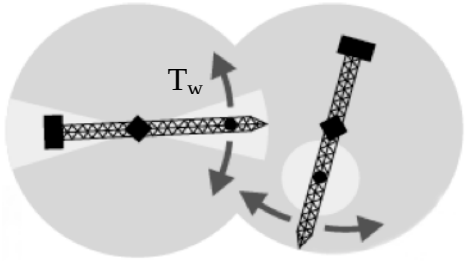

Figure 4- Trolley tangent movement

The second move is trolley tangent movement (T_w) (see Figure 4) (Alkriz and Mangin 2005)

T_w = – ….5

T_w: time for trolley tangent movement; W: slewing velocity of crane jib (r/min).

To calculate the horizontal travel time between any two points i, j (T_{hij}). The equation contains a coefficient (α) referring to the operator skill. This coefficient is placed in the equation because the operator should slow down while targeting the load either on the trolley tangent movement or on the radial tangent movement, and the velocity of targeting the goal depending on his skill and could be calculated using the following equation (Alkriz and Mangin 2005).

$$T_{hij} = \text{Max}\,(T_a, T_w) + \alpha.\ \text{Min}\,(T_a, T_w) \ldots. \quad 6$$

Secondly, the vertical travel time should be calculated. The vertical movement means the travel time of the hook vertically and could be calculated using the following equation (Alkriz and Mangin 2005):

$$T_{vij} = |Z_{di} - Z_{sj}| / V_v \ldots. \quad 7$$

V_v: vertical hoisting velocity of hook (m/min); $(Z_{di}–Z_{sj})$: vertical distance between the unloading point di and the loading point sj

The total travel time between any two facilities equals the horizontal travel time and vertical travel time. A coordination coefficient (β) is used to represent the coordination between the horizontal and the vertical movements. This coefficient is used because the operator will face more challenges to target the desired load, and the velocity of targeting the load is depending on his skill and his ability to coordinate between the two types of movements (Alkriz and Mangin 2005).

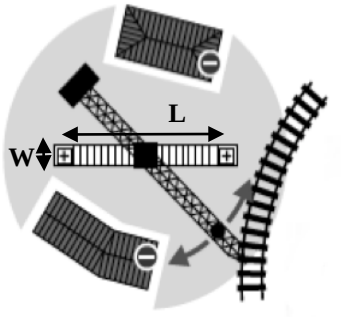

Figure 5 -Travelling tower cranes

$$\text{Total travel time } (T_{ij}) = \text{Max } (T_{hij}, T_{vij}) + \beta . \text{ Min } (T_{hij}, T_{vij})$$

Assigning the travelling tower cranes on the model

The model is going to deal with the travelling tower crane as a fixed building with two dimension (length, width) (see Figure 5) where the width of this building is the spacing between the rails of the tower crane which vary from 5.5 – 6.5 meters depending on the design of the tower crane. On the other hand, the length of the building is considered as a variable and needs to be minimized. The length will be calculated as the distance between two optimized positions for two tower cranes with no obstacles between the two points.

Checks

Coverage check should be applied for every crane by calculating the distance between the facility and the tower crane, then comparing the distance with the tower crane jip. If the distance is more than the tower crane jip, this facility is not covered with this tower crane. The coverage step should be applied on each tower crane (see Table 2), and then total check coverage should be applied to make sure that every facility is covered with at least one tower crane (see Table 3) where (0) means that the facility is covered with the desired tower crane and (1) means that the facility is not covered with this tower crane.

Table 3- Covering check on all tower cranes

	Check Crane (1)	Check Crane (2)	Check Crane (3)	Check all
F1	0	1	1	0
F2	0	1	1	0
F3	0	0	1	0
F4	1	1	0	0
Z1	0	1	0	0
Z2	0	1	0	0
Z3	0	0	0	0
Z4	0	0	1	0
Z5	0	1	1	0
Z6	0	0	1	0
Z7	0	0	1	0
Z8	0	1	1	0
Z9	0	0	1	0
Z10	0	1	1	0
Not Covered Zones				0

Table 3- Coverage check on single tower crane

Crane (3)

	X	Y	Distance	Allowable Radial legnth	Check
F1	50	50	70.71	35.1	1
F2	30	40	50.00	31.25	1
F3	50	55	74.33	30	1
F4	10	20	22.36	23	0
Z1	18	10	20.59	31.25	0
Z2	27	5	27.46	31.25	0
Z3	24	16	28.84	31.25	0
Z4	30	16	34.00	31.25	1
Z5	36	10	37.36	31.25	1
Z6	42	10	43.17	31.25	1
Z7	48	14	50.00	31.25	1
Z8	51	5	51.24	31.25	1
Z9	54	14	55.79	31.25	1
Z10	60	10	60.83	31.25	1

Finally, there is another check that should be applied before running the model. This final check is the check of interference between tower cranes (see Table 4). In tower cranes positioning, tower cranes circles should be intersected to allow the operators to handle loads (see Figure 4). For example, in Figure 4, it is highly recommended to place crane (3) where its reach (circle) intersects with crane (1) reach. However, the intersection should be limited to prevent the first crane jip from hitting the mast of others (see Figure 5).

Table 4- Check of interference

Crane (1)			**Crane (2)**			**Crane (3)**			**Check (1) and (2)**		**Check (2) and (3)**		**Check (1) and (3)**	
X	Y	Length	X	Y	Length	X	Y	Length	Distance	Check	Distance	Check	Distance	Check
34	28	45	42	93	30	75	54	30	65	0	51	0	48	0
No. Of Interference									0					

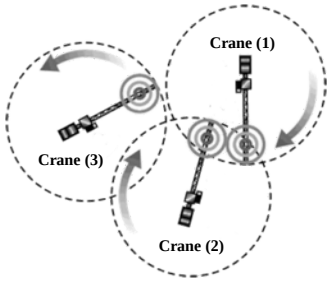

Figure 4- Interference example

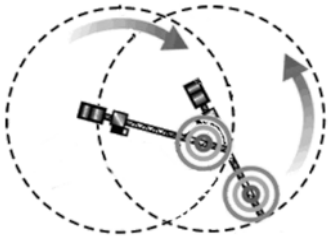

Figure 5- Interference error

CONCLUSION

Due to the rapid development of technology and complexity of construction projects, planning construction site layout became very challenging. Usually, effective site layout leads to cost reduction, duration reduction, and profitability increase. Therefore engineers always search for models for optimum construction site layout. The matter became very complicated if construction site contains tower cranes. This research introduced a Genetic Algorithm (GA) approach to develop a tower crane optimization model. The objective function of the GA model is to achieve the minimum crane travel time between project facilities. The output of the model is the number of tower cranes needed and the proposed position of each tower crane. The model takes also into consideration the case of travelling tower crane where the engineer can minimize the cost by using only one tower crane instead of two. This would happen by using one travelling tower crane on rails where the crane has the ability to move from one place to the other.

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Acquirer's Protection vs Demolition of Illegal Buildings

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Abstract:
In the last decades, Spanish landscape has suffered a deep transformation. Buildings have appeared here and there, especially near the sea, and frequently without respecting urban law. In order to end with such situation, courts started to condemn liable persons to demolish buildings without permit or with an illegal permit. The main problem, which focuses the attention of this paper, is the second one: buildings with illegal permit. These ones are registered in the Land Registry, where it is shown that the construction permit was obtained. They seem to be legal and citizens acquire them trusting in this information. But years later they see how their apartments are demolished because that permit was illegal, and indemnity is not guarantied for them. They lose their property and the price. How can they be protected? Different interests – public and private- concur on these cases, and an adequate solution must be found. The purpose of this paper is focused on two questions: 1) analysing this serious problem and judicial decisions in this matter, and 2) according to the result of this analysis, proposing a way to resolve or mitigate the consequences of demolition, so security in real estate transactions can be restored..

Keywords:
Property, urban law, illegal permit, bona fides acquirer, Land Registry.

1 Introduction

One of the main problems in Spain, as far as construction is concerned, is the respect of Urban Law. When a building is contrary to Urban Law rules, we say that it is illegal. However, causes and conditions of the illegality are not always the same. In fact, circumstances related to the illegality can be very different from one case to another. Sometimes, the developer did not apply for the building permit and the lack of permit makes the building illegal. But in other cases the permit has been obtained and it is disclosed through the Land Registry, although it is an illegal permit because it was issued in spite of the Urban Law prohibitions. And in this case, bona fide acquirers buy the property trusting in the information provided through the Registry, which contains the building permit. Apparently, in this case the acquirer is acting according to law, and he ignores that the building is illegal.

However, even though there is a bona fide acquirer, the court will order the demolition of the building if urban law is considered not to be respected. The bona fide acquirer

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suffers the consequences of the illegality. He was not responsible of the illegal permit and trusted in the legal information provided through the Land Registry. Nevertheless, his house or apartment will be demolished. And according to Spanish law, it will be very difficult for him to obtain an indemnity for the lost of his property.

There is a conflict between public and private law, between urban law and property law. Public interests related to the conditions of the buildings and private interests of acquirers are contradictory. And this problem must be resolved taking into account all the private and public elements concerned in this matter. Security in land transactions and respect to urban law are affected by this conflict and a satisfactory solution must be found.

Along this paper I will explain the problem from both public and private points of view. And I will try to offer a proposal in order to approach two positions which seem to be impossible to conciliate.

2 Illegal Permits and the solution from Urban Law

Unfortunately, the Spanish landscape sometimes consists of buildings contrary to urban law prescriptions. In some cases the illegality is due to the absence of the building permit –it happens very often in the countryside-. In other cases the construction is carried out with all the legal formalities and the building permit is obtained, but this permit is illegal. Why?

In a reduced number of cases, there is a mistake of the municipality, so the permit is provided contrary to Law but without realizing of it. More frequently, corruption and kickbacks are in the root of the problem –in fact, some politicians have been condemned or are being judged for these crimes-. The developer is interested in constructing a building which is prohibited by urban law. But such a building will allow him to make a lot of money –i.e., a building with a number of floors over the maximum established by urban law prescriptions-. In order to obtain the building permit, the developer offers some benefits –usually economical benefits- to the responsible person at the municipality, so the illegal permit is issued. Then, the construction is carried out with a building permit and it seems to be legal because all the formalities have been accomplished. But actually it is illegal, and both the developer and local authorities know it.

Such behaviours have been produced frequently in certain areas of Spain where economical interests and investment play an important role, i.e. next to the sea. And during the housing bubble it gave rise to a complete transformation of the landscape: buildings have appeared everywhere, without control, and in an unmeasured way.

As a reaction against this situation, almost systematic in some cases, courts started to order the demolition of illegal constructions. Demolition is synonymous of destruction of wealth, so it never used to take place in Spain in cases of breach of urban law. It was preferable to establish another consequence in case of illegal buildings, i.e. an economical compensation. Nevertheless, under current circumstances illegal permits are so usual that courts and some authors (Rodríguez-Fernández, 2009; Cabello-Martínez and García-Sanz, 2010) consider demolition as the only way to restore legality. There

are many judicial decisions ordering the demolition, for instance, the sentence of the Spanish Supreme Court of July 9th, 2007 (La Ley 79397/2007), which contains all the legal arguments to order the demolition –basically the need to restore legality- and refers to several sentences resolving in the same way.

The problem is that demolition is ordered in any case of breach of urban law, without taking into account the circumstances of each case. As explained above, the illegality can be the result of a mistake or a conscious action. And in any of both cases, the current owner of the building could have nothing to do with the breach of law. The developer may have sold the house to a bona fide purchaser who spent all his savings in this acquisition, subscribed a mortgage loan and established his home in the building which has to be demolished. Nevertheless, the court does not make any distinctions and orders the demolition regardless the owner's attitude. The situation is even worse for the acquirer when he has to repay the loan to the bank even after the demolition of the building.

Consequently, demolition seems to be unfair in case of a bona fide purchaser who did not suspect at the time of closing the contract that the building was contrary to urban law (Revueta-Pérez and Narbón-Laínez, 2010). Everything looked legal because there was a building permit and the house was registered in the Land Registry. But this bona fide purchaser will have to suffer the consequences of the illegality: the demolition. Let us examine the situation of this acquirer and his protection according to Spanish Law.

3 Bona fide purchasers: protection or punishment in Spanish Law?

If the construction is carried out without a building permit, registration cannot take place in the Spanish Land Registry. One of the prerequisites for registering the building is the permit, so if it has not been issued, registration will be refused by the registrar. The absence of registration reveals the lack of the building permit, and the acquirer can easily realize of the irregularity and he can suspect that there is a breach of law. In this case, if the court orders the demolition, the purchaser will suffer the consequences of the illegality even though he did not take part in the construction. His decision of buying the house was risky and he knew it. Since he decided to buy a non-registered house, he entered into an illegal relationship and now he has to bear the consequences. These are the arguments held by the Supreme Court in the decision of February 6th, 2007 (La Ley 1589/2007).

Nevertheless, in case of a registered building -and registration of the building permit- the behaviour of the purchaser is completely different and Law should be different too. But according to the current judicial decisions, such purchaser suffers the same consequences than in the case described above and he loses his property. Besides, if there was a mortgage loan, the mortgage disappears with the destruction of the mortgaged object –the demolition of the building-, but the loan persists and the acquirer has to face the repayment. The situation is especially dramatic when the house is the home of a bona fide purchaser who loses it with the demolition.

The consequences of the breach of urban law are not distributed in a right way. Authorities of the municipality and the developer have caused the breach of law, but

they are not punished for their behaviour. The demolition is suffered by the current owner and partially by the community because the expenses of the demolition are paid by the municipality with public funds. There are not any consequences for the authorities and the developers who were conscious of their acts and provoked the breach of law with the illegal permit.

The problem has reached an international dimension: it is quite common that European Citizens buy a house in the cost of Spain, where urban development has been extraordinarily excessive in the last years and illegal permits are usual. They follow all the steps to acquire a house according to Spanish Law and, like Spanish acquirers, lose their property with the demolition and without indemnity. The problem is the same for both, Spanish and other European Citizens. But as far as people from other countries are involved, several claims have been made at the European institutions and hard critics to the Spanish real estate transactions and legal security have been issued. A clear example is the Auken Report of the European Parliament. This report pays attention to the irregularities of the Spanish municipalities as far as urban law is concerned and the deficiencies of the Spanish legislation, and denounces the infringement of ownership right when demolition is ordered. Besides, the report claims liability of the authorities who allow behaviours related to illegal buildings. The result –concludes the report- is the mistrust in the Spanish legal system and in real estate transactions: bona fide purchasers are not protected because they lose their properties without indemnity.

Let us explore now whether the legal protection of bona fides acquirers could be improved in the cases of illegal permits. First, we will analyze the solutions offered by the courts in order to conclude if they are satisfactory or not. Then, we will examine the problem from the perspective of Land Registry Law. It is important to bear in mind that the illegal permit is disclosed through the Registry as a legal one and that registration has very strong effects in Spanish Law.

3.1 Protection Suggested by Courts

Owners of illegal buildings have sued to avoid the demolition, especially when they were bona fide purchasers. Nevertheless, courts are very strict in this matter and hold that the only way to restore legality is by pulling down the building. Obstacles to demolition alleged by owners are refused by courts: modifications of the urban planning, proportionality between the illegality and the sanction, legal or physical impossibility to accomplish the sentence, and conclusive title of the current owner. Some examples are the decisions of the Supreme Court of April 29th, 2009 (La Ley 58399/2009) and July 9th, 2007 (La Ley 79397/2007). And it is considered that bona fide purchasers can obtain the protection of their legal interests through other ways. That was stated in the sentences of the Supreme Court of May 12th, 2006 (La Ley 57549/2006), September 26th, 2006 (La Ley 119633/2006), February 6th, 2007 (La Ley 1589/2007), February 4th, 2009 (La Ley 14506/2009), and December 29th, 2010 (La Ley 217776/2010).

From courts' point of view, remedies should be found in contract law and in tort law. Let us see now these remedies and their obstacles.

3.1.1 Contract Law

If the object of the contract –the house or the apartment- is illegal, the contract is void. However, instead of recognizing it, courts hold that there is a breach of contract and the purchaser should claim in order to obtain the restitution of the object and the price, and a compensation for damages.

But the success of such a claim is not easy for several reasons (Revueta-Pérez and Narbón-Laínez, 2010). First, it is required that the purchaser has an evidence of the seller's fault. It means that the seller knows the illegality of the permit at the time of the sale. When the seller is the developer, it is quite possible that he was conscious of the real circumstances of the permit; however it is very difficult to prove it. And if the seller is a former acquirer, he probably had nothing to do with the illegal permit and was conscious of it. Second, even if the acquirer was able to prove the seller's fault, the restitution of the building would not be possible because of the demolition. And third, in most of the cases the restitution of the price would not be effective for practical reasons: the developer is usually a company with limited liability and has not enough assets to pay, or in other cases the company has disappear as a consequence of the current economical crisis. Under these circumstances, a compensation for damages will find the same practical obstacles.

Shortly, from a theoretical point of view the restitution of the price and the object of the contract could be a possible solution. Nevertheless, the practice demonstrates that it is not the way to provide adequate protection to bona fides purchasers.

3.1.2 Tort Law

As said before, in some cases there is not a contractual bind between the persons who dealt with the illegal permit and the purchaser. That is the case of the purchaser of a former purchaser. Then, contract law cannot provide the solution, and tort law could be, perhaps, the tool that we are looking for in order to protect the current owner of the building.

However, also in this case it is very difficult to prove that the developer knew the illegality. And fault is a prerequisite for compensation, so the claim could hardly have success. Besides, in this case there are the same practical problems to obtain an effective compensation due to the limited assets of the company and the risk of disappearing for bankruptcy.

Both contract law and tort law are unable to satisfy bona fides purchaser's interests. But the developer is not the only one who can be responsible of the illegality. The municipality issued the illegal permit and could be also liable for such behaviour (Rico-Ruíz and Casado, 2007).

3.1.3 The liability of the municipality

The municipality issued a building permit contrary to urban law. This illegal permit produced the appearance that the building was under the prescriptions of Law. And a bona fide purchaser acquired it in the belief that there were not any legal obstacles to his ownership right.

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But later a court holds that the building permit is illegal and that the building has to be demolished, with the subsequent prejudices to the current owner of the house. So this owner can sue the municipality for issuing an illegal permit. From a practical point of view, the problem is that condemnation of the municipality means that the indemnity would have to be paid with public funds. So all citizens would have to support this liability with their taxes, which does not seem to be fair.

Besides, in practice it would be very difficult to make the effective payment of the compensation because currently, and due to economical crisis, Spanish municipalities have very limited funds.

Consequently, nor a claim against the developer, nor a claim against the municipality would have success in practice, and the current owner of the demolished building could not obtain a compensation for damages. However, in Spanish Law there are other rules that could provide protection: property law and especially the regulation of the Land Registry. But courts are reluctant to recognize the effectiveness of these rules in these cases. Let us see now how the protection through the Land Registry could be provided and its obstacles.

3.2 Protection through Land Registry Law: Why not?

In Spain there is a title registration system. However registration is not required to become the holder –except in case of mortgage-. But those who register their rights obtain special protection in spite of non-registered rights. And if certain prerequisites are accomplished, the holder with a registered right will have conclusive title.

When the owner is a bona fide purchaser, and the court orders the demolition because the building permit is illegal, it is usual that this owner claims the protection provided in article 34 LH (Ley Hipotecaria, the Spanish Land Registry Law). According to this article, the person who acquires a property right through an onerous contract, in bona fide, from a person who is registered as the owner, and registers the acquisition, becomes the real owner even if the transferor's right is voided or resolved.

From these purchasers' point of view, the illegal permit is a case of conclusive title (Guilarte-Gutiérrez, 2011). Let us see their arguments.

The Land Registry discloses the legal situation of the property. There is a legal presumption: what is published is right and there are not any mistakes, the right exists in the disclosed terms and it belongs to the registered holder (article 38 LH). This is a disputable presumption, so anybody can prove that one registration is wrong. However, in the meantime the presumption produces some legal effects. And it is also the basis to recognize cases of conclusive title. Anyone who trusts in the rights disclosed through the Land Registry and acquires the right with the prerequisites of article 34 LH is protected by Law. He has an indefeasible title. It can occur even in really serious cases, for instance, when the seller obtained the property through a criminal behaviour. If the acquirer is in the situation described in article 34 LH, his title will be indefeasible (Revueta-Pérez and Narbón-Laínez, 2010).

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According to these ideas, the purchaser of a house or an apartment with an illegal permit is acquiring a void title. The title is void because the object of the right is contrary to the law, is contrary to the prescriptions of urban law. But it seems to be legal because of the disclosure provided through the Land Registry and the presumption of article 38 LH. Part of the legal information provided through the Land Registry is related to urban law. The RD 1093/1997 set up that some matters related to urban law must be registered. Spanish Land Registry discloses the title, but also the building permit. In fact, the ownership right cannot be registered if the applicant does not submit the building permit. So it appears that everything is according to the law. And under these circumstances the purchaser acquires the right, trusting in the information disclosed through the Land Registry. Therefore, if a court holds that the building permit is contrary to Law, it means that the ownership right of the transferor is void because the object of the right –the house or the apartment- is illegal. But if the transferee is a bona fide purchaser with the prerequisites of article 34, he should have an indefeasible title and should have to be protected from demolition.

If the Land Registry would not take into account the building permit, the legal problems related to it could not be under Land Registry law. But as far as the building permit and other circumstances related to urban law are disclosed through the Land Registry, and they are included in the registration of the ownership right, all these circumstances should have to be protected. Otherwise, security in real estate transactions would not be properly provided through the Land Registry (Revueta-Pérez and Narbón-Laínez, 2010). Acquirers could not trust in the legal information disclosed because it could be wrong, and in that case the purchaser would suffer the consequences. Although apparently everything is right, it could not be guaranteed.

In short, the ownership right of the apartment is contrary to law because the building permit is illegal. The ownership right is void. But if there is a bona fide purchaser, his right must be protected even if it is illegal. Security in real estate transactions must be provided so he should be considered to have an indefeasible title, and the building could not be demolished. That would be the consequence according to Land Registry law.

However, courts refuse these arguments. Article 34 LH is not considered as a way to protect the ownership right against an illegal permit. The rule is referred to the case of avoidance or revocation of the transferor's right. And it is completely different to the case of disappearance of the object as a consequence of the law. These are the arguments held by the Supreme Court in February 4th 2009 (La Ley 14506/2009), April 29th 2009 (La Ley 58399/2009), and December 29th, 2010 (La Ley 217776/2010).

This reasoning is not easy to understand. However, it is exactly what courts hold repeatedly in all their decisions related to this matter. It is quite difficult to notice the difference between the case in which the transferor's right is considered void by a court and the case of illegal building permit, which makes the building contrary to law. Courts hold that in the second case the ownership right can subsist without the building. But it is hard to imagine the right of an apartment's owner when the building is demolished (Guilarte-Gutiérrez, 2011).

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Then, why is there a refusal to protect bona fide purchasers? Let us examine now all the interests concurring in these cases and the fears or threats that probably are in the basis of these judicial decisions.

4 The conflict: Urban Law vs. Land Registry Rules

According to urban law, in case of illegal permit the building should be demolished because this is the only way to restore legality. Nevertheless, Land Registry rules set up that the bona fide purchaser must be respected in his acquisition if the prerequisites of article 34 LH are accomplished, even if the right of the transferor is void.

It is clear that in case of a bona fide purchaser, there is a contradiction between urban law and property law. But courts hold that article 34 is not referred to these situations and the solution is demolition. Actually, courts hold that in case of conflict between urban law and property law, the rules of urban law are preferred.

Nevertheless, in some cases there is a breach of urban law but the building is not demolished. Then, the legality is not restored. These cases are exceptions to the general rule. For instance, when the time to sue has expired, courts hold that the illegal building must be respected in spite of the breach of Law (Villanueva-López, 2010). However, article 34 LH is not considered as an obstacle for demolition, even though the Spanish system of security in real estate transactions is in danger with such a decision. Why?

There are some circumstances that could explain, perhaps, the position adopted by courts in this matter. Certainly, article 34 LH is the rule to provide security in real estate transactions. But its application must be extraordinarily unusual because it triggers serious consequences. At the end, article 34 means that an illegality, whatever it is, must be allowed in order to protect a bona fide purchaser. Therefore, this article can operate only in contexts where the level of legal security is high, which involves that effects of article 34 will take place in very few cases. Only in these few cases the illegality could be accepted by Law in order to protect the bona fide purchaser's interests.

According to this argumentation, we have to analyze whether building permits are being issued in Spain in satisfactory terms, as far as legal security is concerned. And we cannot conclude that building permits are mostly legal in Spain (Villanueva-López, 2010). Far than this, procedures to issue building permits do not contain enough control. However, building permits are considered to be legal until a court set up the opposite. And even in case of claim against a building permit, the existence of the trial used not to be disclosed through the Land Registry. So the appearance of legality persisted and the purchaser could not suspect that he was assuming a risk with the transaction because there was not any evidence of it in the Land Registry books.

Under these circumstances, recognizing the protection of article 34 to the bona fide purchaser would trigger the inefficacity of urban law: demolition would not take place and urban legality would not be restored. The building permit would be contrary to Law, and the illegality would persist to protect the bona fide purchaser. And this kind of situations could be relatively usual, so nor an important number of illegal buildings could be demolished, nor urban legality would be restored.

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However, in 2011 there was an amendment of law (Real Decreto-ley 8/2011), so now every claim against a building permit must be recorded in the Land Registry. Such a rule has a clear purpose: every person interested in acquiring a house or an apartment will check the legal situation of the property in the Land Registry. And if there is a trial related to the legality of the building permit, this person will have notice of it. The amendment improves the legal information of the Land Registry, and in case of acquiring the property in spite of the claim, the transferee will not be able to be considered as a bona fide purchaser. Therefore, article 34 LH is excluded.

This amendment is a first step in order to increase security in real estate transactions. If procedures carried out at the municipality were improved too, cases of illegal permits would be reduced, and the landscape of urban law would suffer a deep transformation. In that case, it may not be obstacles to recognize the consequences of art. 34 LH when a bona fide purchaser of a house or an apartment realizes that the building permit is illegal. The application of the rule would be so unusual that the efficacy of Urban Law would not be in danger. Then, the demolition would be replaced for another measure, and liable persons –developer and/or authorities of the municipality- would have to face the consequences of their behaviour.

However, in some cases urban law protects interests with special value, i.e., environment, historic and artistic heritage. It is hard to understand that in these cases the bona fide purchaser should be protected in spite of Urban Law. From my point of view, these cases should be an exception to the general rule, so demolition should take place then to restore legality.

5 Conclusion

Urban Law and Property Law establish contradictory rules for the bona fide purchaser who acquires a house or an apartment with an illegal permit. Until recent dates, courts held that demolition should be the reaction against this breach of Urban Law because that is the only way to restore legality. However, this solution does not provide security in land transactions.

The purchaser must be able to know if there is a trial related to the building permit. New rules order to disclose this trial in the Land Registry books. It would be also desirable that cases of illegal permits would be reduced by introducing controls at the municipality. Under these circumstances, cases of bona fide purchasers would be so exceptional, that article 34 LH could be preferred over urban law because its application would be reduced to exceptional cases. Article 34 LH would not be a threat to the efficacy of Urban Law. Nevertheless, in any case where the permit is contrary to rules protecting environment or historic and artistic heritage, the priority of article 34 LH should have to be refused.

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Climate Change And Power Grid Regulation In Finland

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Abstract:

The climate change causes challenges for the distribution of electricity in Finland and countries with similar weather conditions. The power lines are in Finland situated above the ground and when heavy heaps of wet snow gather on the tree branches, the branches will break under the snow's weight. This often results in the branches to collapse on the power lines causing power shortages that may in worst cases take for days to repair. The problem is of significance especially in the scattered settlements. This has led to a vivid public discussion that the energy companies should take the initiative to lay the old airlines underground and it can be argued that there is a significant public need for such a move. However the legislation concerning the power grids, their placement and the expropriation of private land is at the moment old, ambiguous and non-uniform creating challenges for the process. The outcome of the process is usually not problematic for the parties of the process however its slowness often causes unnecessary harm for both the landowner whose land is expropriated and the company carrying out the power line initiative. Since as little harm as possible should be caused to the land owner when the power lines are located on private property, it can be also argued that it usually causes less harm for the land owner if the power lines are located as underground cables instead of locating them as airlines. Therefore uniform legislation would be needed in order to make the process more efficient.

Keywords:
Climate change, Finland, expropriation, power grid, public needs

1 Introduction

In recent years there has been a growing interest towards climate change. Current research data implies that climate change causes winters to be milder and windier than they previously were.[1]

This will probably show as yearly increases in the annual snowfall, which causes challenges for the undisturbed distribution of electricity. The power lines in Finland are situated above the ground and when heavy heaps of wet snow gathers on tree branches,

[1] VNS 8/2009 vp, p. 117.

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the branches will break under the snow's weight. This often results in the branches collapsing on the power lines causing power shortages that may in worst cases, take days to repair. This is a significant problem especially in the rural areas.

This has led to a vivid public discussion that energy companies should take the initiative to lay the old airlines underground. It is arguable that there are significant public needs for such a move. It is generally accepted that in the long term, the total expenses are smaller if the lines are laid underground than constantly fixing the airlines and paying compensation to those who suffer from power shortages.

For the time being, energy can only be transferred through power lines. For this purpose both, airlines and underground cables are used. In most parts of Finland, the power lines are still located above the ground as airlines. However, the lines are not located over the tree lines as is done in some countries with similar weather conditions.

Both systems, underground cables and air lines, have their pros and cons. While airlines are cheaper, easier to locate and to fix, they are vulnerable to weather conditions and they often have a negative aesthetic effect on the landscape. They can also cause danger to people and machinery: for example when fixing an airline the repairman may get injured when climbing to the pylon or agricultural machinery may hit the power lines.

The underground cables usually require less space and hence cause less harm to the land owner who has to submit to the limitations of land-use if the power lines need to be located on his / her land. They are also better secured from the weather conditions such as wind and snow. Furthermore, they are better approved by the public, because they are the less visible. However they are much more expensive than the airlines, more difficult to fix and subject to technical problems. Furthermore, it is very difficult to dig the lines into soil which has high stone concentration and nearly impossible where the bedrock is close to the surface.

The legislation concerning power grids, their placement and the expropriation of private land is at the moment ambiguous and non-uniform. This creates challenges for the process which tends to be slow and bureaucratic. An average power line initiative can take up to eight years with all its phases and this can result in significant harm for all the parties involved including private land owners and energy companies.

Most of the legislation concerning power grid initiatives is very old. As infrastructure and society has changed after these Acts have come into effect they do not adequately meet present day needs. For example the Land Use and Building Act (132/1999, LUBA) was effectively copied from its predecessor Building Act (370/1958) this Act had already come into effect in 1958. Since then, the need for electricity has grown substantially and various applications of electricity usage have increased. The decentralized production - which is needed in promoting renewables-based electricity production, e.g. wind farms and smaller scale biomass power plants - also brings along its challenges, creating a growing need for new power lines.

Previous research has not been done in this field in Finland. None of the Finnish ministries possess a complete Guide of the regulatory package on expropriation and permit system concerning the power grid initiatives. Therefore the purpose of this paper

is to examine the permit system and expropriation legislation concerning the power grid initiatives and to point out the possible minefields in this area.

2 The Finnish Power Grid and Permit System

Finland has a free energy market. The Finnish grid is owned and administered by two different bodies: The Finnish national grid is administered and operated by Fingrid Ltd. (comprises of 400-, 220- and the most important 110 kV power lines). The end user distribution, i.e. regional and local grid, is administered by the regional and local electricity companies. The regional grid comprises mostly of the 110 kV lines. The local grid comprises mostly of 20 kV power lines and 400 v lines.

For the 220 and 400 kV power grid initiatives an environmental impact assessment procedure (EIA) based on the Act and Decree on Environmental Impact Assessment Procedure (Act 468/1994, Decree 713/2006) is required when the power line exceeds 15 km in length. If the initiative concerns power lines with less than 220 kV, Centre for Economic Development, Transport and the Environment can decide whether or not EIA is needed for minor lines.

According to Energy Market Act (385/1995) if the power line is at least 110 kV, a planning permission from the Energy Market Supervising Authority is required. This permission does not yet retain the expropriation permit, and it needs to be applied separately from Council of State. The expropriation permit is granted in accordance with the provisions of Expropriation Act (603/1977, ExpA).

If the power line is less than 110 kV, the expropriation permit can be applied in accordance with the provisions of LUBA. The last part of the power line serving a real estate can be expropriated in accordance with the provisions of Real Estate Formation Act (554/1995, REFA) or ExpA, but it is usually done according to LUBA.

If the airline is at least 220 kV and exceeds 15 km in length the Act on the Right to Expropriate Concerning Certain Initiatives Having an Impact on the Environment (768/2004) gives certain organizations, such as environment protection organizations, right to appeal the permit if they are operating in the area where the initiative is carried out. It is to be noted that the right to appeal applies only to air lines and not the underground cables.

If the power line is located in the water, (for example to pass under the sea, a lake or a river) the right to use privately-owned water bed is established in accordance with the provisions of Water Act (584/2011). In this article the problems concerning location in the waters will not, however, be discussed.

3 Legislation on Expropriation in Power Grid Initiatives

3.1 Conditions of Expropriation

Private ownership in Finland is protected by section 15 of the Finnish Constitution (731/1999). This right may be restricted only by legislation and on condition that there are public needs for it and that full compensation is paid to the owner. Especially the

land owners often need to submit to the limitations of land use for public needs. Public needs are an essential prerequisite for expropriation. Where the public needs requirement is not fulfilled, expropriation is possible only where the procedural requirements for constitutional legislation are met.[2]

In addition, there are certain other principles for expropriation of private land; first, it is very important to notice that the expropriation should always be the *ultima ratio* for land acquisition. In other words, expropriation should only be used if the acquisition has not been possible in any other way. Also, the land owner should suffer as little harm as possible.[3]

Second, the land owner should always be granted full compensation when the land is expropriated. This means that the land owner's financial situation should remain the same despite the expropriation.[4] Even though the principle may seem simple, there are certain problems in it. These problems will not be discussed in this article.

Since permit for expropriation is always required, the existence of a right to expropriate is always at the discretion of the authority. The type of the initiative determines which authority grants the permit for expropriation in the power grid initiatives.

More often than not, the land is not expropriated within the power grid initiatives; instead, a right to use the private land is given to the company carrying out the initiative so that the land owner will remain in ownership of the land after a voluntary agreement is made on the land use, or coercive measures are taken. The land owner will still be able to use the land, but limitations to the land use are usually inevitable. The land owner will be compensated for the harm and damage.[5] The basis for the compensation is laid down in ExpA. The compensation is only paid for economic losses. Hence, sentimental value, for instance, is not compensated.[6]

3.2 The Regulatory System of Expropriation in Power Grid Initiatives

Conditions of expropriation can be divided into two categories: general and special.

The Expropriation Act provides the general legislative framework for expropriation in Finland. The general condition for expropriation is defined in ExpA section 4. According to it, expropriation is possible if required for public needs, but notwithstanding this, expropriation shall not be used if the inconvenience to the private outweighs the public benefit. Public needs are defined as being something more than a public benefit. This is because public benefit may be caused by actions that are not downright required by the public needs.[7]

The provision does not provide an exhaustive list of the circumstances when the public needs exist, nor is there an unambiguous interpretation for the concept. This kind of a

[2] Hyvönen, 1993, p. 31.
[3] Ekroos and Majamaa 2005, p. 725.
[4] HE 179/1975 II, p. 18.
[5] Ekroos and Majamaa 2005, p. 726.
[6] Ojanen, 1976, p. 114.
[7] Kuusiniemi and Peltomaa, 2000, p. 109.

list has not been considered practical, since the circumstances, legal praxis and political views change through times.[8]

Furthermore, according to section 4 of the ExpA, expropriation shall not be carried out if the objective of the expropriation can be achieved by some other means. Usually this means a voluntary agreement with the land owner. This should however not be interpreted so that the energy company carrying out the initiative should always primarily aim to conclude a voluntary agreement with the land owner. On the contrary, it is usually justifiable to carry out the expropriation according to ExpA if the energy company needs to acquire rights to several smaller land areas, as the case usually is in the larger scale power grid initiatives.[9] Despite this point of view, Fingrid for example always tries to negotiate with the land owners before the expropriation process is started.[10]

Carrying out the process according to ExpA has its definite redeeming features, because the principle of equality, secured in the Finnish Constitution, section 6, will be realized between the land owners. It is often also faster to carry out the process according to ExpA instead of negotiating a voluntary agreement with all the landowners separately. If the process is carried out in accordance with ExpA the easements / rights established in the private properties are also appropriately registered. This means that if the owner of the property later changes, the easements will legally bind the successor as well.[11]

ExpA is applied if there is no special legislation concerned. Special conditions for expropriation are defined in several Acts and the conditions are always defined exhaustively.[12] In the power grid initiatives expropriation proceedings can *always* be carried out in accordance with the provisions of ExpA if there are public needs for the power grid. Other relevant Acts concerning expropriation in power grid initiatives are LUBA, Power plant Expropriation Act (168/1928) and REFA.

The Land Use and Building Act has provisions concerning the location of service conduits serving the community such as power lines. According LUBA, section 161 property owners and titleholders are obliged to allow the location of service conduits serving the community or the property in the area they own or hold the title to, unless the location can be organized satisfactorily by some other means and at reasonable cost. Service conduits may not be built so that planning of the area or implementation of a plan is hindered. Unless an agreement is reached with the property owner, the decision concerning the location is made by the local building supervision authority. Causing undue harm to the property shall be avoided when the location is decided upon.

According to section 161, paragraph 3 of LUBA, the owner or titleholder of a property is entitled to be paid compensation for harm and damage caused by the location of service conduits. Unless an agreement is reached on compensation, the matter shall be resolved as laid down in ExpA. Thus, the local building supervision authority only makes the decision concerning the location of the service conduits and does not decide on the compensation to be paid for the land owner.

[8] Ojanen, 1976, p. 42. ; Hollo, 1984, s. 156.
[9] Ojanen, 1976, p. 43.
[10] www.fingrid.fi.
[11] Ojanen 1976, p. 43.
[12] Yli-Laurila 1995, p. 9.

The section requires that the service conduits serve the community or property. In the legal praxis[13] it has been reviewed that the service conduit serving the community referred in the provision may concern a village in the area of the same municipality of the property, but not a service conduit serving the national grid or even the regional grid.[14] However, power lines serving a wind farm have not always been regarded as service conduits serving the community. Hence it is not always clear whether the service conduits serve the community or not. At least it is questionable whether a grid from a private wind farm to a local or regional grid serves that function.[15]

Primarily the location of service conduits serving the community or property, such as power lines, should be organized by some other means, but if this cannot be achieved satisfactorily and at reasonable cost, the land owner is obliged to allow the location on his / her land.

The primary means to carry out the process is hence to negotiate on the location and the compensation with the landowner and only if the parties do not reach an agreement the local building supervision authority will solve the matter. If the land is acquired by expropriation or an easement is established with coercive measures, the provision requires that the landowner should suffer as little harm as possible.[16] In this light it could be argued that least harm is caused to the land owner if the service conduits are located underground instead of locating them as airlines.

The Power plant Expropriation Act *(*PExpA) is a special Act concerning expropriation in power grid initiatives. According to PExpA a property owner can be obliged to give away the property or to submit to the restrictions of the land-use, if a power plant serves a *somewhat* public function. However the provision sets special conditions for the expropriation: It is forbidden to expropriate land from nearer than 100 meters from a building or garden, unless other area cannot be expropriated without a very significant inconvenience instead. The expropriation proceedings are carried out in accordance with the provisions of ExpA.

The Act has been enacted in accordance with the procedural requirements of constitutional legislation. This is because it allows the expropriation of real property for the purposes of a power plant serving only a *somewhat* public function. It has been considered that if the power plant serves a *public function* the public needs exist and the expropriation can be carried out in accordance with the provisions of ExpA. Thus the *somewhat* public function does not fulfill the requirements for public needs, but the public function may fulfill them.[17]

The Real Estate Formation Act*,* section 154 is a provision concerning restrictions to land-use. According to it, to benefit a real estate, a right as a permanent easement may be established in the area of another register unit to place and use the equipment and structures connected with telephone, electricity, gas, heating and other such cables and wiring. Similarly in LUBA, an easement based on an agreement between the landowner and the company carrying out the initiative is the primary method compared to the coercive measures.

[13] See for example Supreme Administrative Court's decision 1994 A 39.
[14] Ekroos and Majamaa, 2005, p. 725.
[15] See Supreme Administrative Court's precedent 1983 A II 109.
[16] Ekroos and Majamaa, 2005, p. 725.
[17] Ojanen, 1976, p..59 ; See also Hyvönen 1993, p. 127.

It is also noteworthy that according to this provision, an easement may only be established *to* benefit a real estate. In practice this means that only the last part of the power line can be located on the property in accordance with the provisions of REFA. This means that the whole power line going through several parcels of real estate cannot be located in accordance with these provisions.

LUBA and REFA are alternatives in the sense that in power grid initiatives concerning regional and local grids with power lines less than 110 kV (not the national grid which always requires a permit grated in accordance with ExpA) the easements may always be established in accordance with the provisions of LUBA. Since the conditions of establishing an easement in accordance with the provisions of REFA are not as broad as in LUBA, section 161, and the process is faster and more flexible in LUBA, the permit for the easement is usually applied in accordance with LUBA, section 161.[18] As mentioned earlier, the whole process can also always be carried out in accordance with the provisions of ExpA, although it is usually impractical, if the process can be carried out in accordance with the provisions of LUBA.

3.3 Public Needs or Somewhat Public Function?

In legal praxis the question whether the power plant serves a public function (public needs) or a somewhat public function has been figured in the Supreme administrative court's precedent 2007:41. In this decision, a power line was needed to serve an industrial plant. The plant had a significant importance for the economy of the area and also involved a local employer, and thus it could have been argued that it served the public benefit. However the Supreme administrative court held that as power lines in question served only the industrial plant and thus it only had a *somewhat* public function. Since the permit for the power line had earlier been granted in accordance with the provisions of ExpA, and no public needs could be identified, the permit should have been granted according to PexpA.

The decision indicates that the line between the public function and the somewhat public function is very open to interpretation. This adds confusion to the already ambiguous legislation.[19]

Travaux préparatoires on PexpA do not clarify the purpose of the Act.[20] PExpA was enacted at the time when the old Finnish Constitution (94/1919) and Finland as a state were barely 10 years old. The interpretation of the Constitution was at the time still much undeveloped. The government bill on PExpA merely states that the Act had to be enacted according to the procedure required for the enactment of constitutional legislation. The reason for this, however, was not explained. It is has been suggested that it was regarded unconstitutional because it infringed the constitutional protection of property rights.[21]

PExpA has been regarded unconstitutional after the enactment of the new Finnish Constitution.[22] Since it was enacted according to the order of procedure required for the enactment of constitutional legislation, it does not pose a legislative problem. However,

[18] Hyvönen, 2001, p. 558.
[19] See also Supreme administrative court's precedents 1982 A I 7-8 and on the contrary 1998:32 about the application of general and special conditions of expropriation.
[20] See Government Bill HE 38/1927 vp, p. 3.
[21] OM 2002:8, p. 16.
[22] OM 2002:8, p. 16.

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if such a legislative initiative was tried to be set today, it would most likely not pass. Therefore it can be asked, should PexpA be struck down as unsuitable for modern society?

Since the energy companies are private players in the market it can also be questioned whether the public needs always really exist when expropriating in accordance with the provisions of LUBA and REFA. Thus it could be argued that they may actually be seen as somewhat unconstitutional as well, but in practice this has not yet been challenged. In most cases public needs can be indicated, but for example, it could be possible to argue that if an electricity company was building a power plant in Finland solely with a purpose to sell electricity abroad with an intent to make profit, it would perhaps be possible to argue that no public needs could be identified.

4 Conclusions

The expropriation process seems to be too slow and too bureaucratic creating unnecessary challenges for decision making. The slowness of the process often causes unnecessary inconvenience for both the land owner and the energy company. Since the legislation is also ambiguous it is not always clear which one of the relevant Acts should be applied in each case.

The obsolescence of the legislation is prone to making the process slow, because it is difficult to apply the legislation in the present day. The relevant provisions were enacted decades ago, when the societal framework was much different than today. One alternative to make the process work faster and more efficiently would be to enact new, uniform legislation for the expropriation and permit system in power grid initiatives.

The line between the public needs and the somewhat public function and hence which one, ExpA or PExpA, should be applied is not either anywhere near clear. The purpose of PExpA has not been clarified either and therefore it can be asked whether the Act should be struck down completely. Comprehensive legislative initiative will be taken concerning the power grid regulation, it should be considered whether there is any requirement for this outdated Act anymore.

Since all the measures should, when expropriating, be taken so that as little harm as possible is caused to the land owner, it can be argued that less harm is caused if the power lines are placed underground instead of placing them on the land owner's property as airlines. This could in fact be interpreted so that the new power lines should always be laid as underground cables, since this causes least harm to the land owner compared to the airlines. On the other hand it can be argued that it is sometimes for the public benefit to locate the lines above ground for economic reasons.

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Environmental Law And The Restrictions On The Right To Use And Enjoy Property In Nigeria

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Abstract:
In Nigeria, there are provisions in our Laws for the protection of the rights in property and the right to use and enjoy property. There have been efforts to control the use of property due to the realization of the need to protect the environment as a result of many years of uncontrolled human use and pollution of the environment in Nigeria, which have exerted cumulative pressures on the ecosystem. These pressures are increasing daily with population growth-leading to urbanization, deforestation, depletion of sea and land resources to produce food – increase in the use of machines and chemicals and other side effects of human activity and development. The aim of this paper is to examine the Nigerian Laws on environmental Laws for the good of the society and for the enhancement and maintenance of clean and healthy environment for all.

Keyword:
Property, Environment, Protection, Rights and Regulation.

1 Introduction

The freedom to use and enjoy property is guaranteed by Nigerian law but it is trite that the right cannot be absolute. The rights have to be regulated for the good of the society. Nigerian laws have been able to make provisions that can enhance the maintenance of a clean and healthy environment for all. The common law has also been able to provide some regulations in this regards. Thus there is great need for laws to be enacted to control the use of and activities on property and the environment. This is because the state and quality of the environment inevitably depends on the intricate process of the efforts at making a living and enjoying life. These activities have to be regulated so as to get the best out of the environment. In England, the common law has made attempts in this direction. In Nigeria, statutory provisions have been used to control and regulate these activities.

It is the aim of this paper to examine the common law provisions on the use of property and the law of nuisance and the use of property.

2 The Common Law Provisions on the Use of Property

The common law has been able to develop rules regulating and limiting the use of property. Restrictions on the use of property is very important, as unrestricted use of property by owners will lead to chaos. Thus, restrictions and regulations must be placed not only in the interest of other property owners but also in the interest of public health, safety, aesthetic, moral and general welfare of the community.

The common law rules regulating and limiting the use of property are in the law of nuisance, the rule in the case of *Rylands v. Fletcher,* the liability for Animals and fire and Trespass to land. We shall now examine these common law rules.

3 The Law of Nuisance

Nuisance is anything or person that causes annoyance, irritation, trouble, or inconvenience. Legally, what is a nuisance depends on the facts of each case as every inconvenience, irritation or annoyance is not actionable as nuisance. Thus, a nuisance is any unreasonable conduct that interferes with the convenience, lives, safety, comfort or enjoyment of others. In the case of *Walter v. Selfe*[1], Knight-Bruce VC defined nuisance to be:

> *An inconvenience materially interfering with the ordinary comfort physically of human existence, not merely according to elegant or dainty modes and habits of living, but according to plain and sober and simple notion among the English people.*

The law of nuisance deals with the lawful activity of a land owner on his own land which affects the enjoyment of another land owner. Therefore, in order to make sure that every property owner enjoys his property to the maximum, without infringing on others' freedom, the law of nuisance imposes some restrictions on the land owner's use of his land. In the case of *Thompson Schwab and Another v. Caslaki and Another*[2]*,* Evershed M.R. stated that:

> *... the conduct of the defendant which results in the nuisance is of itself not necessarily or usually unlawful. A private nuisance may be and usually is caused by a person doing on his own land something which he is lawfully entitled to do. This conduct only becomes a nuisance when the consequences of his acts are not confined to his own land but extend to the land of his neighbour,*
>
> 1. *Causing an encroachment on his neighbour's land when it closely resembles trespass.*
> 2. *Causing physical damage to his neighbour's land or buildings or works or vegetation upon it, or*
> 3. *Unduly interfering with his neighbour in the comfortable and convenient enjoyment of his land.*

[1] (1851) 64 E.R. 849 at 852
[2] (1956) 1 W.L.RJ. 335 at p. 338

Generally, nuisance involves a condition which unduly interfers with the use and enjoyment of land. Thus, it was stated that:

> *The essence of nuisance is a condition or activity which unduly interferes with the use and enjoyment of land… it is an act or omission which is an interference with, disturbance of or annoyance to a person in the exercise or enjoyment of (a) a right belonging to him as a member of the public when it is public nuisance or (b) his ownership or occupation of land or of some easement, profit or other right used or enjoyed in connection with land, when it is a private nuisance.*[3]

Thus, a nuisance may be public or private. Usually public nuisance affects the generality of the populace.[4] It is penal in nature and it is enforced by the state, unless the individual has suffered over and above the generality of populace. Therefore, it is thought convenient to allow the state to seek redress for such inconvenience.

At Common Law public nuisance is defined as:

> *A misdemeanor… either by act or omission to cause substantial annoyance to the subject of the Crown in general by exposing to danger or in other ways affecting injuriously their lives, health, property or even morals or by obstructing them in the exercise of the rights common to all subjects of the realm.*[5]

Nuisance is a case law and can only develop when there are cases in court which widens the frontiers of available doctrines. Hence, it is trite to say that the legislature is the only pulse of the society to maintain the balance between the tedious process of growth of the common law and the needs of a technologically and economically competitive world.

Flowing from the above, it can be asserted that under the common law the law of nuisance has been able to regulate the use of property by owners in such a way that they do not cause discomfort to others and diminution of property. But, it is not the case that any mode of user which lessens the comfort or endangers the health and safety of a neighbour and his property will amount to nuisance. This is as a result of the fact that, the law of nuisance does concede some degree of discomfort and pollution in certain cases.[6] Although, the development of the law of nuisance has not been astute in making sure that the degree of tolerance required is reduced to the barest minimum.

4 The Rule in the Case of Ryland v. Fletcher

[3] Clark and Lindsell on Tort, 14th Edition p. 803 Article 1391
[4] The Criminal Code Act, Cap. 38, Laws of the Federation of Nigeria
[5] Turner, J. Ed. Outhnes of Criminal Law Cambridge (Cambridge 1958) p.389
[6] St. Helen's Smelting Company v. Tipping (1865) 11 H.L. Cases.

This rule which evolved from the case of *Ryland v. Fletcher,*[7] was propounded by Blackburn J. in the court of first instance as follows:

> *A person who for his own purpose brings on his land and collects and keeps there, anything likely to do mischief if it escapes must keep it in at his peril and if he fails to do so, he is prima facie liable for all the damage which is the natural consequence of its escape.*

This rule is that of strict liability. Whenever the requirements of the rule are satisfied, liability will lie whether the defendant was negligent or not. The rule is aimed at protecting the property of a person from damage caused by the escape of non-natural things from the land of another. In the case of *Read v. Lyons,*[8] it was held that personal injury does not come under the rule. Thus, it could be stated that the rule represents another of the methods devised by the common law to control and regulate the use of private property.

Under this rule, is the issue of non-natural user of land. However, whet is non-natural user of land is not fixed. It is capable of changing as technology develops and in accordance with the requirements of the age. Thus what has been regarded as non-natural may subsequently, due to technological development and the needs of the society be regarded as natural user.[9] As a result of this fact, *Ryland v. Fletcher*[10] as a rule can be said to be an inadequate remedy for regulating the use of property as it has not been able to respond quickly to the needs of the times.

Despite the above fact, it has been shown[11] that our courts have applied the rule in cases involving the petroleum industry, to protect the interest of land owners from dimunition due to petroleum operations. Despite the fact that petroleum operations may be regarded as done for the common benefit of all (a defence under the rule), it should not be forgotten that, in most cases, the communities whose land and environment are polluted suffer terrible hardships. In view of this, their sufferings require adequate compensation. Thus, the maxim *ibi jus ubi remedium* should apply.[12] However, there are statutory provisions regulating the operations in this sector.[13] Despite this, there exist some gaps that need to be filled.[14]

5 Liability for Animals and Fire

The owner of animals has duties to keep them in such a ways as not to constitute annoyance to his neighbours. This duty of the owner of animal is imposed by law. The common law has always recognized the effect of uncontrolled animals to the land. The common law has also developed what is called cattle trespass by which the keeper of cattle is under a duty at common law to keep his cattle within his premises. In such a case, if the cattle should stray to a neighbour's land to cause damage, the property owner may bring an action in trespass.

[7] (1947) A.C. 156.
[8] (1947) A.C. 156
[9] British Celanese v. Mint (1969) 2 All E.R. 1252
[10] Supra
[11] Adewale O. Rylands v. Fletcher and the Nigerian Petroleum Industry Vols. 8 and 9 J.P.P.L p. 37
[12] Ogbuigwe A.E. Compensation and Liability for Oil Pollution: Need for a Approach Vol. 3 J.P., P.L. P.7
[13] Petroleum (Drilling and Production) Regulations (L.N. 69 OF 1969).
[14] Dreper v. Hodders (1972) 2 Q.B. 56

Although the keeping of animals provide a variety of comfort and pleasure. However, where the animal is not properly maintained, it could cause damage to the environment and disrupt both the physical condition and the aesthetic beauty of our environment. The improved methods of raising animals, like piggery and poultry, is another source of pollution to the environment. Issues as stench pollution and noise pollution from animals may amount to nuisance which may cause the owner of such animals to be liable.[15]Naturally, some animals are destructive. The law conceed that where the animals are naturally on the land there will be no liability if they escape to cause damage. But where they had been brought on to the land by the land owner, he has a duty to make sure that they do not escape to go and cause damage on adjoining land. The law stands even if the owner knows or ought to know the savage disposition of his animals. Thus, the law is aimed at restricting the right to use and enjoy property for the common good of all.

With respect to liability for fire, the Fire Prevention Metropolis Act 1774-26 modifies the common law position to exonerate person who are not negligent in preventing the spread of fire. The law is to the effect that a land owner cannot ignore a fire that starts on his land. It is correct to state that the destructive effect of fire if uncontrolled is usually devastating. Therefore, it is important to prevent its spread. As a result, the law imposes a duty on the land owner from whose land a fire starts to prevent it spread to adjoining land.

6 Trespass to Land

Every unauthorized invasion of property is trespass. However, minute an invasion of property is, it is trespass as long as the invasion is unauthorized.[16] The entry into the property of another and projecting substance from one's land to that of another are regarded as trespass to land. Thus the main aim of the law of trespass is to prevent one's property from unauthorized interference and from pollution created by his neighbour. In the case of *Gregory v. Piper,*[17] some rubbish were placed by the defendant on his land. He left the rubbish to dry. It was his intention to dispose of them properly when they are dried. Unfortunately, the rubbish were blown by the wind into the land of his neighbour. The court held the defendant liable.

The restrictions provided by the common law are necessary in the interest of the health, safely, religions, morals and general welfare of the people. Thus, it was stated by *Luxmoore, J. in the case of Vanderpant v. Mayfair Hotel Company Limited,*[18] that:

> *"every person is entitled as against his neighbour to the comfortable enjoyment of the premises occupied by him."*

Therefore, an invasion of the comfortable enjoyment of property will amount to trespass.

The foregoing discussions, support the fact that the Common Law as applicable to Nigeria has been able to provide some restrictions on the right to use and enjoy property in Nigeria. Although, there are not many cases that have been before the courts on these topics, some form

[15] Abiola v. Ijeoma (1970) 2 All N. L.R. 268
[16] Entick v. Carrignton (1765) 19 St. Tr. 1030
[17] (1829) B & c 591.
[18] (1930) 1 Ch. 138

of control have been achieved in respect of the few cases that were before the courts especially with respect to the law of nuisance and the use of property.

7 The Law of Nuisance and the Use of Property

Where an action in nuisance is founded on the use of property which has causes inconvenience, annoyance or discomfort, such inconvenience, annoyance or discomfort, must be shown to be substantial. The classic formulation of the rule is that of *Luximoore J. in the case of Vanderpant v. Mayfair Hotel Co. Ltd..*[19] According to Luxmoor J.:

> *Every person is entitled as against his neighbour to the comfortable and healthy enjoyment of the premises occupied by him, and in deciding whether, in any particular case, his right has been interfered with and a nuisance thereby caused, it is necessary to determine whether the act complained of is an inconvenience materially interfering with the ordinary physical discomfort of human existence, not merely according to plain and sober and simple notions obtaining among the English people.*

This rule has been cited with approval in several cases in Nigeria. In the case of *Moore v. Nnado,*[20] the plaintiff alleged nuisance by the defendant. According to the plaintiff, the defendant caused excessive noise in his neighbouring palm wine bar by playing stereograms unreasonably loudly until late every night. That as a result of the noise, he had been compelled to seal up his louvre windows with sheets of plywood and to spend most of his time in the back yard to his house.

It was held by the learned judge that:

> *"the degree of nuisance from the defendant's premises was more than the plaintiff is expected to tolerate in the circumstances."*

Moreover, in the case of *Abiola v. Ijoma,*[21] the plaintiff and the defendant were occupying adjoining premises in a residential area in Surelere, Lagos State. As a pastime, the defendant kept poultry at the back of his house. In 1969, he purchased four hundred day-old chicks which he kept in pens erected against the boundary wall. The boundary wall was about five feet from the plaintiff's house. It was claimed by the plaintiff that excessive noise made by the chickens in the early hours of the morning disturbed his sleep. He also claimed that nauseating smells from the pens interfered with his comfort. Therefore, he sought damages and an injunction to restrain the alleged nuisance.

The court awarded the plaintiff damages and an injunction restraining further acts of nuisance by the defendant.

Furthermore, in the case of *Tebite v. Nigeria Marine & Trading Co. Ltd,* the issue of interference with enjoyment of land in the Nigerian context was examined by Atake J. In this case, the

[19] (1930) 1 Ch. 138
[20] (1967) F.N.L.R 156
[21] (1970) 2 All N.L.R. 268

plaintiff, a legal practitioner, occupied premises at No. 11 Robert Road, Warri, which he used as his chambers. At No. 9 Robert Road, the defendants had a workshop where they carried on the business of boat building and repairing. An action for nuisance was brought by the plaintiff against the defendants. The plaintiff alleged that by operating their machines continuously for several hours a day, the defendants had persistently caused to emit from their workshop loud and excessive noise and noxious fumes which diffuse his premises and cause him much discomfort and inconvenience.

It was held by the learned judge that, in respect of both the noise and the smells, substantial interference with the plaintiff's comfort and convenience had been proved, and he was entitled to damages and an injunction to restrain continuance of the nuisance.

8 Conclusion

This paper probably has succeeded in discussing the restrictions on the right to use and enjoy property in Nigeria and in examining the common law provisions on the right to use and enjoy property. We have been able to show that although there are not many cases that have been before the courts, some form of control have been achieved and the freedom to use and enjoy property is guaranteed by Nigerian Law. Although there exist some gaps that need to be filled. However, it has been shown that Nigerian courts have been able to make decisions that can enhance the maintenance of a clean and healthy environment for all. Moreover, the common law has also been able to control the right to use and enjoy property.

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The impact of amendments to the Collective Investment Act of 2003 on the share-price of Listed Property Funds in South Africa

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Abstract:
The aim of the research is to determine the impact of the ammendments to the Collective Investment Act on the performance of the listed sector on the Johannesburg Securities Exchange (JSE) Limited. The ammendments were made in 2003 and in 2008. The ammendments made in 2003 proposed changes to the capital structure of Property Unit Trusts, to be able to gear up to 30% of their underlying value. The literature reviewed in the research suggested that there should be an impact on the performance of the shares and returns of the companies when there is change in the capital structure of the listed companies. Three measures were applied to the changes to determine if there has been significant impact: risk measure using Sharpe adjustments; value at risk measure; and events studies. The aim of using the three measures is to determine without doubt that changes made to the capital structure of the Property Unit Trusts impact on the performance of the listed companies. Comparison was made for the period 1996 to 2003, before the announcement of the amendments to the Collective Investment Act, and the period 2003 to 2008, after the announcement. The research is in progress and will be completed in the course of 2012. This paper introduces the framework for the research and the literature reviewed. A second paper will be prepapered for future presentation, covering the results and conclusion.

Keywords:
Collective Investment Act, Property Loan Stocks, Property Unit Trusts, Return, Risk

1 Introduction

There are two types of listed property companies in South Africa: Property Loan Stocks (PLS) and Property Unit Trusts (PUT). These companies are listed on the Johannesburg Securities Exchange (JSE) Limited under “Financials – Real Estate”. The South African listed property sector has delivered attractive returns over recent years, but neither of the current structures, compared to Real Estate Investment Trusts (REITs), offers international investors the uniformity and simplicity which would facilitate international investment.

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1.1 Property Unit Trusts (PUTs)

A Property Unit Trust is a portfolio of investment grade properties which date back to 1969 when two trusts were established and listed on the JSE Limited. Each portfolio is listed on the JSE under "Real Estate Investment Trusts", A PUT generates value for the investor in two ways: through rental income of the properties in the portfolio, and through the appreciation in the values of these properties over time.

Investors in PUTs therefore get a share of the portfolio's rental income in the short term, while the value of the units themselves increase in the longer term, mainly because of the rising value of the properties in the portfolio.

PUTs are managed by experienced and reputable management companies, responsible both for the day-to-day operation of the properties and leases, and for the investment strategy of the trusts.

Today, the sector comprises six listed trusts, with a total market capitalisation of over (as at beginning of 2008) ZAR24-billion. The prices of listed PUTs are quoted on the JSE Limited (SA) and are published in the pages of most daily newspapers, under the "Real Estate" heading.

1.2 Property Loan Stock companies (PLSs)

Property Loan Stock companies invest solely in property. As with all other companies property loan stocks are subject to the Companies Act, JSE regulations and are governed by their own memorandum and articles of association.

The main difference between property loan stock companies and other companies is the method whereby the owners fund the company. When you purchase a linked unit in a property loan stock it is comprised of part share and part debenture (or loan). The debenture (loan) portion of the linked unit earns interest at a variable rate. The interest comes from net income (after expenses), which the loan stock company achieves from rental streams from the properties in which the company invests.

Usually property loan stocks distribute all their revenue profits, mainly through debenture interest with the balance being paid out as a dividend. Distributions are paid as often as quarterly by several property loan stock companies, and at the very least twice during each fund’s financial year. These regular distributions provide a steady cash stream and are tax transparent.

The conditions and terms of the debentures, including rate of interest payable and repayment dates are governed by the debenture trust deed and independent trustees are appointed to look after the interests of debenture holders.

1.3 Comparison with Real Estate Investment Trusts (REITs)

There are a number of common features between PUTs and the international Real Estate Investment Trusts, or REITs,, which include the distribution of income from the property investments in the form of net rental or an interest distribution, which is taxable in the investor’s hands; restrictions on the type of assets that the trust invests in

(typically types of property investments); guidelines on the amount of income that needs to be distributed; and limitations on the level of debt on the balance sheet.

More recently, implementation by the JSE of the FTSE-JSE Africa Index series has resulted in a "Real Estate" sector which includes PUTs, PLSs as well as property holding and development companies, although the JSE continues to run a sub-index specifically for PUTs. With the recent promulgation of the Collective Investment Schemes Act on 2008, PUTs are technically collective investment schemes in property, but are still referred to as PUTs as the nature of the investment remains the same.

2 The research problem

The existing approach to capital regulation in the United States of America and European Union, based on the so-called “Basel I” and “Basel II”, was identified by many regulators and commentators as one of the key factors contributing to the global financial crisis of 2008. Under the pre-crisis capital adequacy rules, the minimum regulatory capital levels of banks were insufficient in relation to the exposures and actual losses of the banks suffered during the financial crisis. Also the quality of regulatory capital appeared often insufficient to absorb bank losses effectively. The capital adequacy rules of Basel I and Basel II did not adequately capture risks posed by bank exposures to transactions such as securitizations, derivatives and repurchase agreements or take into account the systemic risks associated with the build-up of leverage in the financial system. Moreover, Basel I and II focused on capital only, with no internationally agreed quantitative standards for liquidity. This is often perceived to have been a serious shortcoming when the financial crisis unfolded in 2007 and liquidity evaporated in the key funding markets used by many banks and bank-sponsored vehicles.

Property unit trusts (PUTs) and property loan stocks (PLSs) are convenient, listed vehicles for investing in property. Amendments to legislation introduced the Collective Investment Schemes Control Act of 2003, allowing PUTs to gear up to 30% of the value of their underlying properties. This makes PUTs indistinguishable from PLSs in terms of their capital structure (debt and equity structure) so that there is a need to undertake a comparable investment analysis of the performances of the two types of listed property funds. Before 2003, PUTs were allowed to gear up only to five percent of their property value, whereas PLSs were allowed to gear up to any level acceptable by the management company. This modification has brought PUTs’ risk profile to a similar level to that of PLSs.

The aim of the research is to determine the impact of the amendments of the Investment Collective Act on the performance of the PUTs and PLSs using three methods, namely:

a. Risk adjusted returns
b. Value at Risk
c. Event studies

3 Literature review

3.1 Risk and Return

Risk can be classified as either systematic or unsystematic. Systematic risk affects all investments to a certain degree and can be eliminated through diversification (Ross, Westerfield and Jordan, 1998). Examples of systematic risk are uncertainty about general economic conditions, interest rates, inflation and legislative risk. An estimation of systematic risk is crucial for determining the expected return of an asset. Ross *et al* (1998) states the expected return of an asset depends only on the asset's systematic risk. The specific measure of systematic risk is the beta coefficient. The beta coefficient tells how much systematic risk a particular asset has in comparison to an average asset.

3.2 Capital Structure

3.2.1 Modigliani Miller Propositions

According to Modigliani and Miller's first proposition, the capital structure of a firm has no significance on the total value of the firm where taxes are ignored (cited in Bodie, Kane and Marcus, 1999). As has been discussed above, taxes were ignored on this research so "M & M Proposition I" is applicable when comparing PUTs and PLSs. The market value of PUTs and PLSs should be independent of the securities used to provide the financing but should be dependent on the earnings flow generated by the company's investments. Therefore, PUTs and PLSs with the same risk, borne by the same type of properties, having the same asset value and producing the same cash flow, should yield the same return.

In the research, the weighted average cost of capital (WACC) is:
$WACC = (E/V) \times R_E + (D/V) \times R_D$
Where E is the proportion of equity
D is the proportion of debt
V is the sum of E and D
WACC can also be defined as the required return on the firm's assets.

Replacing WACC with R_A, the return on assets and rearranging the above formula gives Modigliani and Miller Proposition II in the no-tax case:

$$R_E = R_A + (R_A - R_D) \times D/E$$

The formula states that the cost of equity depends on the required rate of return on a firm's assets, R_A (WACC), the firm's cost of debt, R_D, and the firm's debt equity ratio (Ross *et al*, 1998).

Before the amendments to the legislation governing PUTs, PUTs had no significant borrowings, meaning D = 0, implying $R_E = R_A$.

3.2.2 Security Market Line

The cost of equity (Ross *et al*, 1998) from the Security Market Line is:
$$R_A = R_f + (R_M - R_f) \times \beta_A$$

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Where β_A = firm's asset beta, a measure of the systematic risk of the firm's assets
R_f = risk free rate
R_M = market risk

According to the Capital Asset Pricing Model, the most widely used means of estimating equity hurdle rates (Harris and Marston, 2001) is:

$R_E = R_f + (R_M - R_f) \times \beta_E$
Where β_E = Equity beta.

Assuming no tax,
$\beta_E = \beta_A \times (1 + D/E)$

which explains the impact of financial leverage on the cost of equity.

3.3 Risk Adjusted Returns

The calculated average returns are not accurate so it is necessary to adjust for risk in order to make meaningful comparisons. Two measures for risk adjustment are discussed below.

3.3.1 Sharpe Measure

Ross *et al* (1988) described Sharpe's measure as a measure that compares entire investment portfolios by using total risk to adjust the returns.

Sharpe measure = $(r_P - r_f)/ \sigma_P$
where r_P = the portfolio return
r_f = risk free return
σ_P = standard deviation

3.3.2 Traynor Measure

According to Ross et al (1988), the Traynor measure uses only the systematic risk to adjust the returns.

Traynor measure = $(r_P - r_f)/\beta_P$
where r_P = the portfolio return
r_f = risk free return
β_P = beta of the portfolio

Bradfield (2003) observed that historical data over a longer period than five years may be of little relevance because the nature of business risks undertaken by companies over long periods changes significantly. He recommended a period of five years for calculation of beta coefficients. Hence, the both the Sharpe measure and the Trayner measure were used to calculate the risk adjusted returns of the PUTs and PLSs over the two periods (1996 to 2003 and 2003 to 2008).

3.4 Value at Risk

The Sharpe and Traynor Measures above are not the latest methods commonly used in portfolio performance evaluations (Alexander and Baptista, 2003). The more common measures use value at risk (VaR), defined by Alexander *et al* (2003) as a "measure of the additional average rate of return that investors would have earned if they bore an additional percentage point of VaR by moving a fraction of wealth from the risk free security to the portfolio of risky securities that they have selected".

Alexander *et al* (2003) explained that evaluating performance of portfolios using VaR is useful for practitioners and researchers because the ranking differs notably from the one arising from the Sharpe ratio, since VaR takes into account the probability density function of the portfolio's rate of return.

Chow and Kritzman (2002) observed that, in portfolios that hold long positions in assets with typical returns and risk profiles, the assumption of portfolio log-normality does not seriously misstate value at risk.

3.5 Portfolio Theory

Markowitz (1957) identified the benefits of a collective measure of the importance of all of an investor's holdings. He observed that, if the covariance of the expected returns of the investments is negative, when one investment performs well while another does not, the volatility or degree of risk inherent in the portfolio will be minimised. Bodie *et al* (1999) explained that the risk of a portfolio can be minimised for a given expected return by the selection of a portfolio along the efficient frontier. All portfolio managers wish to hold their investments along the efficient frontier to maximise the possible expected return for a given level of risk. They further explained that the risk that is minimised by portfolio theory is unsystematic risk or non-market risk.

3.5.1 Risk Sharing and Risk Pooling

Investors strive to achieve the highest expected returns for a particular risk by diversifying risk through reducing the value that is at risk within the portfolio. Typically in property investments, a diversification strategy would include diversification across geographical regions, types of properties (retail or offices) or different grades of properties.

In risk pooling, the diversification is not sufficient to reduce the value that is at risk within the portfolio. To achieve risk sharing, an investor must spread his portfolio across shares that have negative correlation coefficients.

3.6 Events Studies - Theory of abnormal returns

The theory of abnormal returns is based on the Capital Asset Pricing Model of William Sharpe (1962). The model calculates expected returns of a portfolio and the residual or abnormal value on the return is referred to as abnormal return. There have been adjustments to the Sharpe model, notably Black's model (1972) which modified the risk free part of the Sharpe Model. Black made observations that post world war markets, the risk free factor overstates the expected returns. For purposes of this research, the

Sharpe model was applied in the calculations of expected returns as it remains an acceptable finance model in calculations of expected returns. In addition, the Sharpe model is much easier to compute for the JSE Limited's stocks and the model has not been disproved.

3.7 Capital Asset Pricing Model (CAPM)

3.7.1 Sharpe Model

A model that describes the relationship between risk and expected return and that is used in the pricing of risky securities.

The general idea behind CAPM is that investors need to be compensated in two ways: time value of money and risk. The time value of money is represented by the risk-free (r_f) rate in the formula and compensates the investors for placing money in any investment over a period of time. The other half of the formula represents risk and calculates the amount of compensation the investor needs for taking on additional risk. This is calculated by taking a risk measure (beta) that compares the returns of the asset to the market over a period of time.

3.7.2 Black's Model

Black, Jensen and Scholes (1972) have given evidence that the Sharpe's CAPM has not described expected returns adequately in the "post-war" period, and that the following equation seems to fit the data better than Sharpe's CAPM:

$$E(Rit) = E(Rzt) + \beta i[E(Rmt) - E(Rzt)] ,$$

for any security i, where Rzt is the return on a minimum variance portfolio of risky assets which are uncorrelated with the market portfolio.
Rmt is the market return.

In other words, Black et al found evidence that high beta securities tend to be overvalued, and low beta securities tend to be undervalued. One possible interpretation of this result is that high beta stocks tend to be low yield stocks, and what is really happening is that low yield stocks are overvalued, and high yield stocks are undervalued. If this were the case, then the result would be associated with corporate dividend policy rather than with factors such as capital structure that affect the returns of a corporation's common stock.

Described below are the details of the application of Black's model in event studies as described in Brown and Warner (1980). Brown *et al* (1980: 208) stated that "the market and risk adjusted returns' model presumes that some version of the Capital Asset Pricing Model generates expected returns. In Black (1972) two parameter Asset Pricing Model, $E(R_{it}) = E(R_{zt}) + \beta_i[E(R_{mt}) - E(R_{zt})] = K_{it}$ for any security i, where R_{zt} is the return on a minimum variance portfolio of risky assets which are uncorrelated with the market portfolio.

R_{mt} is the market return.

In Black's model, the abnormal return ε_{it} is equal to $R_{it} - [R_{zt}(1-\beta_i) + \beta_i R_{mt}]$

Therefore, the return which is realized on security i in period t, Rit is given by

$R_{it} = K_{it} + \varepsilon_{it}$,

Where K_{it} is the expected return given by the model above, and ε_{it}, which is the component which is the abnormal or unexpected."

4 Research Methodology

4.1 Collection of Data

Data on monthly stock prices and actual dividends paid were collected for the period 1 January 1996 to 31 December 2008. Data was obtained from I-net Bridge, Investment Property Databank and published annual reports, mainly Provest's PUT and PLS Report and Catalyst's Listed Property Sector Monthly Overview.

For the value at risk analysis, the underlying value of each PUT and PLS with market capitalisation in excess of R600 million was tracked over the 15-year period of the research. The data on PUTs, from I-net Bridge, was available from January 1993.

4.2 Analysis of Data

4.2.1 PUTs versus PLSs Returns' Analysis

From the monthly closing stock prices, the annual returns were calculated as:
% Return = ((closing stock price + dividends paid in period – opening stock price)/closing stock price) x 100%.

Annual returns were analysed to determine the difference in performance of PUTs from that of PLSs. This was because, firstly, annual returns show strong normality characteristics from the NCSS analysis; and, secondly, annual returns eliminate auto-correlation, as observed by Gilberto (2003).

The returns were computed over one-year, three-year, five-year, seven-year, 10-year and 15-year periods for both PUTs and PLSs. The results were then analysed using NCSS software to determine whether there is a statistically significant difference between the two samples. The two-sample t-test was used to determine the difference between PUTs and PLSs at 0.05 significant levels.

The returns were then adjusted for risk using the Sharpe measure for the 18 months from July 2003. The risk free rate of 7.82% was used, that is, the R153 bond rate as at 30 December 2004, the date at the end of the period under study. The same risk free value was used in all risk adjustment of returns.

The annual risk adjusted returns were calculated as:
(% Return at year n – 7.82%)/ Standard deviation for year n

The monthly risk adjusted returns were calculated as:
(% returns at month n – 7.82% * n/12)/ Standard deviation for month n.

The NCSS software was used to determine whether there was a significant difference between the two samples of PUTs and PLSs at the 0.05 significance level.

In order to analyse the impact of the amendment to the Collective Investment Act that allowed PUTs to leverage as much as 30% of their underlying values, returns were then analysed for the period July 2003 to December 2008. From the monthly closing stock prices, monthly returns were calculated as:

% Return at month n = ((closing stock price at month n + (dividends paid during period)*n/6 – opening stock price)/closing stock price at month n)* 100%.

4.3 Value at Risk Analysis

Kollenberg (2002) described a procedure for the computation of VaR to determine whether diversification has been achieved as the underlying asset value of the fund increased. The VaR is ascertained as the percentage volatility multiplied by the total underlying asset value of the fund. VaR values are then plotted as a function of the underlying value of the fund. If VaR increases at a rate equal to the growth of the fund value, then no diversification has been achieved. However, if the VaR increases as the fund grows, but at a lesser rate, then diversification has been achieved. This is measured by calculating the slope of the least square regression of the VaR as a function of the underlying value of the fund.

Value at Risk analysis was completed for the period 1996 to 2003 and for the period 2003 to 2008. Comparison of the two periods was made.

4.5 Event Studies Analysis

The SENS announcement was our primary source of information that could impact on share-price on the date of the announcement or the event date. Brown and Warner (1980, 1985) gave a good background on the use of event studies' methodology in measuring share-price performance. Brown *et al* gave details of the methodology and explained the different circumstances and suitability of each method.

In South Africa, the Event Studies methodology has been widely applied to share-price analysis of companies on the JSE Limited exchange. The methodology has been applied to analysis of share-price reaction to equity financing (Bhana, 2002), analysis of share-price reaction to key executives lay-offs (Bhana, 2003a), analysis of share-price reaction to layoffs (Bhana 2003b) and performance of corporate restructurings and spin offs (Bhana, 2004).

The most aggressive analysis of event studies, the use of market adjusted returns, was applied to get the most effective analysis of the impact on the share-price. The market and risk adjusted returns model takes into account both market-wide factors and systematic risk of each sample security.

4.5.1 Application of the CAPM in Events Studies analysis

For each security in the sample, the return is regressed from day -20 through +10 against the returns on the market portfolio during the corresponding days. This model regression yields a residual in each event-related day for each security. For each security, the market model residual is its measure of abnormal performance.

4.5.2 Cumulative Average Residuals (CARS)

When there is incomplete prior information about when an event occurs we can use of cumulative average residuals (CAR) technique as employed by Fama, Fischer, Jensen and Roll (1969). The technique focuses on the average market model residuals of the sample securities for a number of periods around the event. The cumulative average residual is defined as the value of the cumulative average residual of the previous event-day plus the current value of the average residual, AR_t.

$$CAR_t = CAR_{t-1} + AR_t$$

For a given sample and a given level of abnormal performance, we take the average market model residuals and begin cumulating them in day -10; accumulation then occurs for every day through to +10. For each procedure (share-price) the accumulation yields 21 cumulative average residuals, one for each event-related day.

When the CARs are plotted on a graph ("CAR plots"), when there is abnormal returns, we get fractiles (one large spike (up or down)) on the event day.

5 Expected results

It is expected that the amendments in the Act that has allowed the changes to the capital structure of the PUTs and PLSs will have an impact on the performance of the returns and share-price of the listed companies. The risk profile of the companies is expected to change hence the risk adjusted returns of the listed companies should reflect this change. The Value at Risk measure is also expected to give results showing that the risk profile, as a result of the change in the capital structure, has changed - due to the amendments to the Collective Investment Act.

From the results, it is expected that the risk adjusted returns of the PUTs should differ for the period 1996 to 2003 to the risk adjusted returns of the period 2003 to 2008. It is also expected that the values at risk for the different periods should also differ. In addition, it is expected that the impact of the announcement of the amendments to the Collective Investment Act should be different on the returns and share-price of the PUTs compared with the returns and share-price of PLSs.

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IMPACT OF THE SOUTH AFRICAN GAUTRAIN ON PROPERTY VALUES

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ABSTRACT

The Gautrain rapid rail project, providing a vital rapid rail link between Johannesburg, Pretoria and the OR Tambo International Airport, was at US$3000 million the largest construction project in Africa. Announcement of the project has led to widespread speculation on the anticipated impact of the project on the property market in areas surrounding the proposed stations. This study investigated the anticipated impact of the proposed Hatfield Gautrain Station on office property values in the Hatfield precinct in Pretoria. The research findings indicated a small positive impact on office property values. The overall anticipated impact of the Gautrain on the property environment was relatively small.

Keywords: Gautrain, property values, Hatfield, property market, Pretoria, South Africa, rapid rail.

INTRODUCTION

The introduction of the first Rapid Rail transit project in South Africa was announced in early 2000. The project that forms part of ten Spatial Development Initiatives (SDI's) is called the Gautrain Rapid Rail System with a total construction period of more than eight years to complete all the phases. The rapid rail system connects Johannesburg with Pretoria and the OR Tambo International Airport, providing a high speed alternative transportation mode to travellers.

Apart from the fact that the Gautrain project is expected to decrease the traffic congestion it is also possible that the project could have an impact on the property values surrounding the stations. The Hatfield station, located in the Hatfield suburb to the east of the Pretoria Central Business District (CBD) was selected as the research precinct. There is a number of mixed land uses surrounding the proposed Hatfield station.

IMPACT OF TRANSIT STATIONS ON PROPERTY VALUES

Booz et al. (1999:1) argue that the introduction of rail transit into a region often creates expectations about the impact of the rail project on property values. According to Brinckerhoff (2001:1) the impact of rail transit on property values has been studied from many perspectives, including analyses of different types of systems (e.g. rapid, commuter, light rail), of residential versus commercial impacts, and studies which

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have attempted to isolate both the positive and negative effects. Research studies that focus on the impact of railway stations on property values are often incomplete and limited with mixed findings (Booz et al. 1999; Debrezion et al. 2003). The reason why the studies usually have mixed and sometimes contradicting results are due to the different methods of analysis and the fact that projects in different locations will not have similar effects (Bows and Ihlanfeldt 2001; Banister 2005). The Hedonic pricing method is generally a preferred approach adopted to determine the impact of a transit station on property values as the method includes the physical characteristics of a property (Banister 2005; Boucq 2007; Debrezion et al. 2003). However, for the purpose of this study it is foreseen that the Hedonic price method technique will not be used to test the hypothesis, mainly because there is not enough information available to conduct the hedonic price method.

A number of research studies indicate that the introduction of a rapid transit station in a metropolitan area could have an influence on the economy and hence change the property values in the area (Damm et al. 1980; Brinckerhoff 2001; Czamanski 1966; Doherty 2004; Banister 2005; Cervero 2009; Debrezion et al. 2003). According to Booz et al. (1999:1) the effect of new fixed guideway transit investments is two-fold; firstly it improves the convenience of accessing other parts of a region and secondly, it enhances the attractiveness of property, increasing the likelihood that property can be developed or redeveloped to a more valuable and more intense use. There is however a number of research studies indicating an increase in property values as a result of introducing a railway station in a region (Damm et al. 1980; Brinckerhoff 2001; Czamanski 1966; Doherty 2004; Banister 2005). According to Debrezion et al. (2003:4) the positive impact of rail stations will decrease further away from the rail station causing a price curve to form.

Apart from the accessibly function, a number of underlying factors or pre-conditions have an influence on the impact of a railway station on property values (Cervero 2003; Doherty 2004). “Two factors having a positive influence on property values are the access advantage by rail transit and commercial services and two factors which have a negative impact are negative external effects such as noise, pollution and the unsightliness of stations and crime that might be higher near stations” (Bows & Ihlanfeldt, 2001:2). While the majority of researchers indicate that light railway stations do have a positive impact on property values, there is a school of thought indicating the opposite (Ryan 1999; Cervero and Duncan 2002; Doherty 2004).

A number of underlying pre-conditions need to be in place for a transportation project to have a positive influence on property values. These include the availability of attractive development sites, supportive planning policies and strong local economies (Doherty 2004; Cervero 2003). Other elements that could also have an influence on the impact of a transit station are the type of railway system (Cervero 1994; Landis et al. 1994; Debrezion et al. 2003) and the type of property market (Doherty 2004; Debrezion et al. 2003).

THE INFLUENCE OF TRANSIT STATIONS ON COMMERCIAL PROPERTY VALUES

Literature relating to the impact of rail transit on commercial property values demonstrates a similar result as the impact on residential property values due to the fact that there is no consensus among the outcomes of the studies. Commercial

property values are influenced by the return on investment the property provides to an investor. The return on investment is directly related to the rental income of the property (Schiller 2001; Downing 2001; NPEC 2004). Commercial property users have to optimize their production decisions in a spatial context and their spatial demand functions reveal willingness to pay for commercial space at particular locations (Ball et al. 1998:55).

A number of researchers indicated that there is a positive relationship between commercial property values and railway stations (Cervero and Duncan 2001; Nelson 1999). There are however several past studies (e.g. Falcke, 1978 as cited by Cervero and Duncan 2001; Landis et al. 1994) indicating that rail transit confers no measurable benefits to commercial properties. Other supporting factors as highlighted by Cervero (1994) and cited by Cervero and Duncan (2001:5) indicated that mixed use development projects were better performers than single developments. A number of research studies indicated that the impact of rail transit stations on retail property values tends to be more sensitive than the impact on office property values (Damm et al. 1980; Downing 2001). It is important to highlight that the impact on commercial property values, as with residential values, will only occur within a certain radius surrounding stations of approximately 1.6 kilometer radius (Cervero and Duncan 2001; Debrezion et al. 2003).

RESEARCH METHODOLOGY AND DATA USED

The research study was based on systematic observation and analysis of quantitative measurements and secondary data sources were used as part of the measurement instruments. Due to the fact that the quantitative research design was used it was imperative that only credible and reliable data be used as part of the analysis. The institutions that were used for the purpose of obtaining the necessary data are all credible institutions that have been in existence for a number of years. The institutions provided their methodologies in terms of their databases before the data were analysed. After an evaluation of the methodologies it was clear that all the methodologies used by the institutions were sound and unbiased.

The secondary data sources used as part of the analysis were:

- City of Tshwane Metropolitan Municipality (CTMM),
- South African Property Owners Association (SAPOA),
- Quarterly Rode Reports as published by Rode and Associates,
- Lightstone Property Database
- Investment Property Databank (IPD)
- City of Tshwane Hatfield Development Framework.

Quantitative research was conducted through a non-equivalent comparative control group design technique. The non-equivalent control group design is a scientific quasi-experimental research technique to determine the impact an intervention has on a control group that has not been exposed to the intervention, compared to another group that has been exposed. The interrupted time-series design was also used as part of the analysis when the necessary data was available. The interrupted time-series design represents an improvement on the pre-measurement and post-measurement design in that it keeps some of the threats (historical events, spontaneous development, instrumentation) at bay.

For each analysis a comparative market was identified. A comparative market (control group) was chosen with which to compare the Hatfield data. The difference in the two market areas will thus provide an indication of the impact. It was however imperative to choose locations within the City of Tshwane Metropolitan Municipality (CTMM) that have similar characteristics as the Hatfield market. Due to its characteristics the Brooklyn node was chosen as the comparative market for the impact on the values of office properties.

The information supplied by the secondary sources consists of a number of office property indicators which were selected according to their relevancy. Each Excel data sheet was scrutinised in order to determine any discrepancies or outlier that may exist in the time-series data. The data was divided between the measurements prior to and after the announcement of the Gautrain project. Thereafter, the data was analysed in order to determine the pre- and post measurement of each indicator. Both the Hatfield and the Brooklyn nodes were examined in order to create a comparative analysis. A series of graphs were plotted to visually display the results in a way that made it possible to draw certain conclusions from them.

ANTICIPATED IMPACT OF THE HATFIELD GAUTRAIN STATION ON THE OFFICE PROPERTY MARKET.

In order to measure the anticipated impact a selected number of office market indicators were analysed in the Hatfield and Brooklyn node. The Brooklyn node was chosen as the comparative precinct due to the fact that the Brooklyn node represents similar characteristics when compared to the Hatfield node.

The office property market is influenced by a number of indicators. However, for the purpose of this analysis, only some of the indicators (those that can be quantified) have been included. The result of the analysis should provide a good indication of the impact of the anticipation of the Hatfield Gautrain station on office properties in the Hatfield node.

Measurement of each indicator used as part of the analysis both before and after the announcement of the Gautrain EIA process in 2002 is summarised in Table 1. The table also provides an indication of the comparative impact as measured for each individual indicator.

Table 1: Summary of the office property market indicator analysis.

Indicator	Hatfield office property market analysis			Brooklyn office property market analysis			Impact
	Before	After	Difference	Before	After	Difference	
Total return on investment	15.5%	23.6%	8.1%	9.2%	21.1%	11.9%	None
Income return	12.3%	11.8%	-0.5%	11.8%	9.8%	-2.0%	Small
Capital growth	2.9%	10.6%	7.7%	-0.5%	10.4%	10.9%	None
Net income growth	5.0%	5.1%	0.1%	5.8%	7.7%	1.9%	None
Net income yield	11.4%	10.6%	-0.8%	9.3%	8.9%	-0.4%	None

Indicator	Hatfield office property market analysis			Brooklyn office property market analysis			Impact
	Before	After	Difference	Before	After	Difference	
Growth in capital value	9.4%	41.6%	32.2%	5.2%	30.8%	25.6%	Big
Vacancy rates	6.6%	4.0%	-2.6%	5.4%	2.3%	-3.1%	None
Rent per month							
Average	9.6%	9.2%	-0.4%	10.3%	8.2%	-2.1%	Small
A+ grade offices	10.9%	10.2%	-0.7%	11.0%	9.9%	-1.1%	Moderate
A-grade offices	10.7%	10.7%	0%	11.2%	9.6%	-1.6%	Small
B-grade offices	10.3%	9.0%	-1.3%	15.1%	7.9%	-7.2%	Big

Notes: If the Brooklyn node outperformed the Hatfield node the impact was captured as none.
If the Hatfield node outperformed the Brooklyn node by 1% or less the impact was moderate.
If the Hatfield node outperformed the Brooklyn node between 1% and 2% the impact was small.
If the Hatfield node outperformed the Brooklyn node by more than 2% the impact was big.

From Table 1 it is clear that the announcement of the Gautrain EIA process did not have a significant impact on the office property values in the Hatfield node. The Hatfield node outperformed the Brooklyn node in a number of indicators, but there are contrary results.

- The highest positive impact was measured in the growth in capital value as well as the rent per month in B-grade office buildings.
- A small positive impact was measured for the average office rentals, A-grade office rent and income return,
- A moderate positive impact was measured for the growth in capital value per square meter and the A+ grade rent per month.

Five out of the nine indicators indicated negative impact for office properties in the Hatfield node when compared to the Brooklyn node.

CONCLUSIONS

The anticipation of the Hatfield Gautrain station did not have a significant impact on the office property values in the Hatfield node. Although the Hatfield node did outperform the Brooklyn node in a number of indicators there were some indicators which proved the opposite. A number of indicators indicated a short-term positive impact just after the announcement of the Gautrain EIA process in 2002. The positive impact was however not sustainable and only lasted for approximately two to three years.

From the analysis it is thus clear that there is no substantial evidence to indicate a positive impact of office property in the Hatfield node in anticipation of the Hatfield Gautrain station. None of the indicators analysed indicated a drastic change in the income of office properties in the Hatfield node. As the value of an office property is

determined by the income the property can acquire, it is possible to conclude that the impact was very small or even non-existing.

This result supports the conclusion that research studies that focus on the impact of railway stations on property values often result in mixed findings (Booz et al. 1999; Debrezion et al. 2003). The reasons why the studies usually have mixed and sometimes contradicting results can be ascribed to different methods of analysis, but also the fact that projects in different locations will not have similar effects (Bows and Ihlanfeldt 2001; Banister 2005).

In addition, any possible positive impact may be neutralised by negative impacts., as there are both positive and negative influences resulting from rail transit developments. As pointed out by Bows & Ihlanfeldt (2001:2), there are advantages emanating from the increased accessibility of offices and markets, but also negative external effects such as noise, pollution and the unsightliness of stations and crime that might be higher near stations.

It is clear that any findings indicating either a positive or a negative impact of rail transit stations cannot be extrapolated to similar situations elsewhere, but that each case must be investigated on its own merits.

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SHOULD PUBLIC SERVICE INFRASTRUCTURE BE VALUED FOR PROPERTY TAX PURPOSES?

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ABSTRACT

The imposition of property rates (i.e. property tax) on "public services infrastructure" (i.e. public utilities) in terms of the Local Government: Municipal Property Rates Act (Act no. 6 of 2004) of South Africa, enacted on 2 July 2005 gave rise to various questions, the most important of which can be summarised as follows:

- should public services infrastructure be valued and rated at all;
- what is the definition of plant and machinery – can, for example, both the sleepers of a railway and the rails be seen as plant and equipment;
- is, e.g., a telecommunication tower or mast considered to be plant and equipment;
- how should linear infrastructure for example pipelines and railway lines, crossing local government boundaries, be valued and taxed, given that values and tax rates are determined at local government level?

The valuation of infrastructure is, even at international level, not an easy task. It is concluded that the Property Rates Act should be amended to better reflect international best practice.

Keywords: property rates, public service infrastructure, South Africa, valuation.

INTRODUCTION

The enactment of the Local Government: Municipal Property Rates Act (hereinafter "Property Rates Act") on 02 July 2005 heralded a new era with regard to property rates (i.e. property tax), the most important local tax in South Africa.

In terms of the provincial legislation repealed by the Property Rates Act, property rates could be levied on one of three tax bases, A municipality could choose to tax on the value of land only, or on the improved value, or on the value of the land and improvements as separate rateable objects. In terms of the Property Rates Act the tax base is now uniform for all municipalities, namely "market value" (section 46(1)). It further states that property "must be valued in accordance with generally recognised valuation practices, methods and standards, and the provisions of this Act" (section 45(1)).

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Municipalities cover the total surface area of South Africa. This implies that, in terms of the Property Rates Act, all properties must be valued and is in principle rateable, unless excluded from the tax base. This Act defines "property" as follows:

"property" means –

(a) immovable property registered in the name of a person, including, in the case of a sectional title scheme, a sectional title unit registered in the name of a person;
(b) a right registered against immovable property in the name of a person, excluding a mortgage bond registered against the property;
(c) a land tenure right registered in the name of a person or granted to a person in terms of legislation; or
(d) public service infrastructure.

This paper discusses some of the issues regarding the valuation and rating (i.e. taxation) of so-called "public service infrastructure" (hereinafter "PSI"). PSI could be equated to "public utilities" – as will become clear from the discussion below.

Definition of PSI and lack of a definition of equipment and machinery

According to Grad and Grad (2005), public utilities have generally been defined as private business organisations that are subject to government regulation, which provide an "essential" commodity or service such as water, electricity, transportation or communication to the public. In the South African context PSI is limited to infrastructure which is "publicly controlled", in other words owned by or otherwise under the control of an organ of state, such as a municipality, a municipal-owned company or parastatal.

The Property Rates Act (section 1) defines PSI as follows:

"public service infrastructure" means publicly controlled infrastructure of the following kinds:

(a) national, provincial or other public roads on which goods, services or labour move across a municipal boundary;
(b) water or sewer pipes, ducts or other conduits, dams, water supply reservoirs, water treatment plants or water pumps forming part of a water or sewer scheme serving the public;
(c) power stations, power substations or power lines forming part of an electricity scheme serving the public;
(d) gas or liquid fuel plants or refineries or pipelines for gas or liquid fuels, forming part of a scheme for transporting such fuels;
(e) railway lines forming part of a national railway system;
(f) communication towers, masts, exchanges or lines forming part of a communications system serving the public;
(g) runways or aprons at national or provincial airports;
(h) breakwaters, sea walls, channels, basins, quay walls, jetties, roads, railway or infrastructure used for the provision of water, lights, power, sewerage or similar services of ports, or navigational aids comprising lighthouses, radio

navigational aids, buoys, beacons or any other device or system used to assist the safe and efficient navigation of vessels;

(i) any other publicly controlled infrastructure as may be prescribed; or

(j) a right registered against immovable property in connection with infrastructure mentioned in paragraphs (a) to (i).

This definition generally accords with what is understood to be "public utilities" in Canada (Grad, 2005; Kitchen, 2007), United Kingdom (Sanderson, 2005; McCluskey, 2007) and the United States (Grad, 2005), but read with the definition of "property" is unclear as there are overlapping property categories.

Some common features of all these utility companies include the fact that

- they are large in terms of both financial influence and geography, with values often exceeding billions of dollars (see McCluskey, 2007 – with reference to the United Kingdom),
- they usually cover multiple autonomous taxing jurisdictions,
- they have multiple units contributing to the operation of the firm, and the units are vertically and horizontally integrated, and
- these companies are often under some type of regulatory oversight, or have been in the past.

As stated above, PSI – as a category of "property" – is in principle rateable, and must therefore be valued. However, the current definition and features listed above combine to present policymakers and appraisers (i.e. valuers) with a significant challenge in dealing with these types of property from an appraisal and rating point of view.

Should utilities in principle be valued and taxed?

With reference to especially New Zealand, various authors, for example Young (1993), Sayce and Connellan (1995) and Dent (1996), queried the relevance of the valuation of public assets and, to a lesser extent, the reliability of such valuations. In citing the views of Auckland City Council, Young (1993) suggests that the value of, for example, infrastructural assets, is irrelevant in terms of accounting or operating efficiency, and that the cost of the valuation exercise is a waste of rate payers' resources. Pegler (1993) echoes this view that valuing assets of an infrastructural type is "largely an exercise in futility". In contrast, public utilities are valued and taxed extensively in, for example Canada, where these utilities are often taxed at much higher rates than residential properties (Bish, 2003).

In South Africa, the debate about the question on whether PSI should be taxable or not, was eventually settled by legal opinion that municipalities have a constitutional right to rate infrastructure (in terms of section 229 of the South African Constitution and excluding it per se would likely be unconstitutional). Therefore it was decided to retain it as "property" in the Property Rates Act. However, as certain types of PSIs were not valued and rated before the Property Rates Act became law, the risk existed that if rates are implemented in an irresponsible manner, it may have a substantial impact on the economy, as well as the fiscal environment at national and local

government levels. In 2009 a regulation was therefore enacted which limits the tax rate for PSI to a maximum of 25% of the rate determined for residential properties.

A key issue in South Africa is that valuation is not a national or provincial function, but a municipal responsibility. A "municipal valuer" must value only properties within a relevant municipality and prepare a valuation roll accordingly.

How should utilities be valued and rated?

Subsection 46(5) of the Property Rates Act, which was repealed in 2008, stated that where "available market related data is not sufficient to determine the market value of public services infrastructure, such public services infrastructure may be valued in accordance with any other method of valuation as may be prescribed." However, since its repeal, a municipal valuer have no choice (if the relevant municipality wants to rate PSI) but to determine market value using conventional methodologies. The valuation of network PSI (e.g., pipelines and railway lines) is problematic in South Africa, given that a municipal valuer only operates within a single municipality. In jurisdictions such as Canada (Grad and Grad, 2005; Kitchen, 2007) and the United Kingdom (Sanderson, 2005) it is solved by valuing the network and apportioning values. This can be done, for example, by length (km or metre), or freight volume for railway lines (Kitchen, 2007) and length and diameter for pipelines (Kitchen, 2007). These values are determined nationally (e.g. the Valuation Office Agency in the United Kingdom) or provincially (e.g. BC Assessment Canada) for the whole country or province. Such an agency has been advocated for South Africa to value unique properties (such as PSI) and to also monitor the uniformity and quality of valuations done by municipal valuers (Franzsen and McCluskey, 2000).

A proper definition (either in the Property Rates Act or in a regulation) of "equipment and machinery" (the equivalent of plant and machinery) does not exist, creating uncertainty regarding the nature and thus taxability of certain assets, which may or may not constitute PSI.

In South Africa tax rates are determined locally, but these are at least limited to a fixed ratio (0.25:1) in relation to the rates set for residential properties – as indicated above.

Given the nature of most types of PSI (there are exceptions), the comparable sales method cannot be used to value these properties. However, acceptable alternative methods exist (Horsley, 1991; Cooper, 1993, Thompson, 1993; Dent and Bond, 1993; Bond and Dent, 1996 and 1998; Sanderson, 2005, McCluskey, 2007).

The United Kingdom has managed to avoid many of the problems associated with valuing and rating public utilities by applying a uniform country-wide tax rate and statutory values, i.e. not requiring these utilities to be valued. This perhaps is in acknowledgement of the difficulties involved in determining realistic values for such assets. However, statutory values in the United Kingdom were abolished in 2005 (Sanderson, 2005; McCluskey, 2007). In the United Kingdom public utilities are presently valued utilizing refined versions of the income ("receipts and expenditures")

or cost ("contractor's basis" – annual equivalent of adjusted replacement cost) approaches (McCluskey, 2007)

The most acceptable method of valuation of PSI, where the income approach is not feasible, and which is used in various countries such as the United States, Canada and Australia, is the depreciated replacement cost (DRC). Depreciated replacement cost is defined (RICS, 2012:15) as "the current cost of replacing an asset with its modern equivalent asset, less deductions for physical deterioration and all relevant forms of obsolescence and optimization."

A limitation of the basic depreciated replacement cost approach is that it assumes replacement with assets substantially identical to those existing. The process of "optimisation" is an enhancement of the traditional like-with-like replacement approach that arrives at replacement costs using "modern equivalent assets" performing the same functions as the existing assets. It results in an estimate of the lowest possible cost of replicating existing services using modern materials and modern technologies in the most efficient asset configuration.

A method advocated – as a refinement of the cost approach - called the optimised replacement cost approach (ODRC), is considered by Thompson (1993) and Horsley (1991) to be the most satisfactory method available, particularly for infrastructural assets where there is no, or little, earning. The contractor's basis method, used in the United Kingdom (Sanderson, 2005; McCluskey, 2007) could also be considered.

Although the ODRC method is seen as as a workable method to value many types of PSI, this method is not totally free from criticism. Few advocates of this approach have provided practical examples of how it can be applied to the various types of assets, like heritage assets. It is also clear that, as the approach still requires the estimation of depreciation, the problems relating to this, outlined earlier, still remain. For example, in describing the method, Horsley (1994) simply mentions that the system or network can be depreciated on the basis of the service life of the individual components, but provides no explanation of how the latter is derived.

Also, certain infrastructure requires specialised inputs from, for example, engineers, to aid in the determination of value, thus adding to the cost of the exercise, which may well be beyond the budget of many local authorities.

CONCLUSIONS AND RECOMMENDATIONS

In the context of South Africa and learning from international experiences, some conclusions can be drawn regarding the valuation and rating of PSI in terms of the Property Rates Act:

- PSI should be valued;
- PSI remain rateable;
- the relevant definitions (e.g., 'public service infrastructure' and 'property') in section 1 of the Act should be reviewed;

- to enable valuers to properly value PSI, a definition of 'equipment and machinery' must be inserted in the Property Rates Act (or a regulation);
- only if the definitions referred to have been inserted and amended, as the case may be, will it be possible to value certain types of PSI and only when these are properly valued, can they be rated properly by municipalities.

The following recommendations are made:

- The definitions in the Property Rates Act referred to above should be amended to provide clarity regarding the nature and scope of PSI and equipment and machinery;
- optimised depreciated replacement cost (ODRC) or the contractor's basis could be considered as workable methods of valuation most types of PSI; and
- a national government agency, similar to the Valuation Office Agency in the United Kingdom or the provincial crown corporations in Canada (e.g. BC Assessment), should be established to value all linear PSI centrally, whereafter a pro rata apportionment to municipalities can be made for determining tax liability.

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BENCHMARKING PUBLIC PRIVATE PARTNERSHIP ENVIRONMENTS: EAST ASIAN COMPARISONS

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ABSTRACT

The Public Private Partnerships (PPP) markets in Australia and the UK are considered to be the most sophisticated in the World and used as a model for benchmarking against other countries. In addition the global financial crisis also meant many PPP financiers became risk averse to certain projects and in particular countries. The environment for major infrastructure projects, particularly in 'riskier' countries, has become more difficult. Research conducted by the Economist Intelligence Unit for the Asian Development Bank evaluated PPP policy and programs in a number of countries in the Asia Pacific. The study benchmarks the UK and Australian PPP environments with eleven developing or emerging countries including Bangladesh, China, Indonesia, Pakistan, Philippines, Thailand, Gujarat state in India, Kazakhstan, Mongolia, Papua New Guinea and Vietnam. The comparison was based on indicators developed to provide a sound evaluation of these countries. The indicators include; the legal and regulatory framework, institutional framework, operational maturity, investment climate, financial facilities plus a sub-national adjustment factor. The research methodology and the benchmarking results for each country are summarised.

Keywords: benchmarking; East Asia; public private partnerships.

INTRODUCTION

The quest for increased efficiency in public service delivery, the budget difficulties of many governments, and the growing receptivity of public opinion to the discourses for rehabilitating market regulations has led to a growing number of forms of association between the public and private sectors (Pongsiri, 2002; Bult-Spiering and Dewulf, 2006). These forms of association are generally referred to as Public Private Partnerships (PPP) and have become an integral part of the Federal and State Governments' procurement strategy in many countries (Raisbeck *et al*., 2010; Regan *et al*., 2011a; Regan *et al*., 2011b).

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While the PPP market in Australia is considered to be sophisticated and mature (Hodge, 2000; Duffield, 2005; Bult-Spiering and Dewulf, 2006), several major failures have emerged with infrastructure projects such as the Sydney Harbour Tunnel, Sydney Airport Rail and Sydney's Cross City Tunnel (Jefferies and McGeorge, 2009; Regan *et al*., 2011a). These experiences have sounded a warning for the introduction of new PPPs in Australia and taken together with the difficulty of financing new projects (Regan, et al, 2011b) has slowed the development of new PPP projects. These projects also provide a lesson for other countries in their quest to for new PPP projects to deliver infrastructure projects.

INTERNATIONAL POPULARITY OF PPPS

The concepts underlying PPPs have been used for decades worldwide to procure economic and social infrastructure (Kwak *et al*., 2009). The primary parties involved with a PPP project are the client, concession contractor and constituent members, which are often referred to as a Special Purpose Vehicle (SPV). Various forms of PPP have been found to exist such as Operation and Maintenance and Build Operate Transfer (Reijniers, 1994). Such terms are often used interchangeably, and sometimes they are subjected to differing interpretations. For example, Private Participation in Infrastructure (PPI) is the term used by the World Bank, and Private Finance Initiative (PFI) is used in the UK, Japan and Malaysia (Yescombe, 2007). The governments with the most developed PPP markets focus on using them to enable the public sector to achieve value for money (V*f*M). Value for money (Castalia and World Bank, 2007; Kwak *et al*., 2009) is driven primarily by:

- *risk transfer*: relieving government of the cost of asset based risks (i.e. risk directly associated with build or operating an asset lies with the private sponsor);
- *whole-of-life costing*: through whole-of-life costing the government can achieve optimization between capital costs and operating and maintenance costs, a realistic projection of total cost of ownership, and a way of comparing competing designs on a like-with-like basis;
- *innovation*: providing wider opportunity and incentive for innovative solutions as to how service requirements can be delivered; and
- *asset utilization*: developing opportunities to generate revenue from the use of the asset by third parties, which may reduce the cost that government would otherwise have to pay as a sole user.

In addition, typical benefits that can be achieved include:

- *introduction of the private sector's technical and managerial expertise*: The introduction of the private sector's expertise to the design, construct, maintain and operation of infrastructures and can provide efficiency gains;
- *improved quality of service and performance*: Under most PPP projects full payment to the private sector contractor will only occur if the required service standards are being met. International experience and particularly within Australia suggests that the quality of service achieved under a PPP is often better than that achieved by traditional procurement (Raisbeck *et al*., 2010; Regan *et al*., 2011a).

  This may reflect the introduction of competition, the better integration of services with supporting assets, improved economies of scale, the introduction of innovation in service delivery, or the performance incentives and penalties typically included within a PPP contract. In addition, the private sector has strong

incentives of profitability so that they will be more responsive to customers' needs and preference; and

- *enhanced public management*: The responsibility for providing public services is transferred from government to private sector, so that government can be more focused as regulators to monitor public services provided by the private sector. In addition, PPP introduces competition in providing public services and this reduces the cost of public services to ensure best value for money is achieved.

FINANCING PPPS AND VALUE FOR MONEY

The main reason why some governments pursue PPPs is to access finance that would otherwise not be available to them (Kwak *et al*., 2009; Regan *et al*., 2011b). However, this is not the case in practice, as access to finance by simply deciding to use a PPP is not always possible, especially in the current economic climate after the 2008 Global Financial Crisis (GFC) (Regan *et al*., 2011b). If an infrastructure provider is not assured user fees and government subsidies, it will not be able to recover its costs; the provider will simply be unable to raise the capital needed to build the project (Bennett, and Krebs, 1991). In essence, the government will not be able to attract private sector financing simply by deciding to undertake PPPs—cost-recovery over the project's life would need to be resolved before private capital can be raised (Regan et al., 2011b).

PROBLEMS WITH PPP

Despite the widespread acknowledgement that PPPs can provide value for money, there are also many academics and practitioners who have questioned this underlying proposition because under this arrangement there is a propensity for project complexity to increase and a probability of time and cost blowouts to occur (e.g., Grimsey and Lewis, 2004; Kwak *et al*., 2009). PPPs should be used only if they provide better V*f*M than traditional methods (European Commission 2003; HM Treasury 2006; Raisbeck *et al*., 2010). In Australia, for example, V*f*M is explicitly required before proceeding with a concession PPP project. Value for money is typically determined (a priori) by a public sector comparator (PSC). The PSC represents the net present cost of capital, maintenance, ancillary services, residual value and project risks for the contracted term (Partnerships Victoria, 2003).

The PSC has a risk element measured in terms of transferable and retained risk plus an assessment of competitive neutrality. The PSC estimates the hypothetical risk-adjusted cost as if a project were to be financed, owned and implemented by government. The key issue, however, rests on determining how the PPP can ensure that V*f*M is ultimately delivered to the taxpayer through a project or services provided by the private sector rather than the traditional government model.

The determination and assessment of V*f*M is a complicated process and is reliant upon high quality data, which should only be used after a degree of vigilant reflection (European Commission 2003). Although, it has been hard to establish proper comparisons with what a public sector alternative would deliver, results show that concession arrangements deliver only marginal savings (Institute for Policy Research, 2001; Regan *et al*., 2011b).

THE BENCHMARKING STUDY

The Economist Intelligence Unit (EIU) in 2011 was commissioned by the Asia Development bank (ADB) to develop a *Infrascope* benchmarking exercise for the

Asia pacific region to develop an index of 'PPP-readiness' in any specified country. This index would measure a country's capacity to execute infrastructure PPPs and was based on an analysis of the country's laws, regulations, institutions and practices over time (EIU, 2011:4) in carrying out PPPs.

The study selected four developed benchmark countries (Australia, Japan, South Korea, UK) and eleven developing countries in the Asia-Pacific (Bangladesh, China, Indonesia, Pakistan, Philippines, Thailand, Gujarat State in India[4], Kazakhstan, Mongolia, Papua New Guinea and Vietnam) and their readiness and capacity to undertake PPP projects in water, transport and energy sectors. The index is not designed as an investment tool for private financiers, as it is largely qualitative and aggregated data. The quantitative data, when used came from international statistical sources (mainly World Bank). The index comprises 19 indicators, 4 of which are quantitative and 15 are qualitative. The qualitative assessments were based mainly on primary sources contained in legal texts, government web sites, press reports and interviews.

However, even with its heavy qualitative bias, it is considered that the index does provide a basis for public-private discussions that can lead to better project conditions and policies (EIU, 2011:3).

The index was developed working with a group of regional and sector experts, whose knowledge of PPPs placed them in a good position to evaluate the categories of evaluation (see later). The expert group consisted of country specialists, policymakers, lawyers, consultants, development bank staff, regional and international PPP professionals (EIU, 2011:9).

The index measures readiness and capacity to implement PPPs over a project life-cycle divided into the following five components (EIU, 2011:9):

1. *Legal and Regulatory Framework* (for PPPs in that country);
2. *Institutional Framework* (the design and responsibilities of the country's institutions that prepare, award and oversee PPP projects);
3. *Operational Maturity* (the government's ability to uphold laws and regulations for PPP projects together with the number and success rate of previous projects);
4. *Investment Climate* (the country's political, business and social environment for investment in PPPs), and
5. *Financial Facilities* (for funding PPP infrastructure).

In addition, a sixth category was added to recognise the PPP activity at a regional level by adopting a stand alone *Sub-National Adjustment Factor.*

The weightings of each of the five categories are shown in Table 1. The 19 individual indicators under each category are also listed in Table 2 (EIU, 2011:10-11).

FINAL PLACINGS

The overall scores after taking account of the weightings for each category of assessment are shown in Table 2. It confirms that Australia and the UK with well established frameworks for PPP infrastructure projects are leaders in the field with their infrastructure market being defined by the EIU (2011) as being 'mature'.

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Table 1 Categories and Indicators

ASSESSMENT CATEGORIES					
25% WEIGHTING	20% WEIGHTING	15% WEIGHTING	15% WEIGHTING	15% WEIGHTING	10% WEIGHTING
1. Legal & Regulatory Framework	**2. Institutional Framework**	**3. Operational maturity**	**4. Investment Climate**	**5. Financial Facilities**	**6. Sub-national Adjustment Factor**
INDIVIDUAL INDICATORS					
1. Consistency & quality of PPP regulations	1. Quality of Institutional design	1. Public capacity to plan & oversee PPPs	1. Political distortion	1.Government payment risk	1. Sub national adjustment
2. Effective PPP selection & decision-making	2. PPP Contract, hold-up and expropriation risk	2. Methods & criteria for awarding projects	2. Business environment	2. Capital market: private infrastructure finance	
3. Fairness/ openness of bids, contract changes		3. Regulator's risk-allocation record	3. Political will	3. Marketable debt	
4. Dispute-resolution mechanisms		4. Experience in electricity, transport & water concessions		4.Government support for low-income users	
		5. Quality of electricity, transport & water concessions			

Table 2 Overall Scores

OVERALL SCORES (out of 100)	
MATURE MARKET	
1. Australia	92.3
2. UK	89.7
DEVELOPED	
3. South Korea	71.3
4. Gujarat State	67.6
5. India	64.8
6. Japan	63.7
EMERGING	
7.China	49.8
8. Philippines	47.1
9. Indonesia	46.1
10. Thailand	45.3
11. Bangladesh	39.2
12. Pakistan	38.8
13. Kazakhstan	34.3
NASCENT	
14. Vietnam	26.3
15. Mongolia	23.3
16. PNG	20.8

Source: Adapted from EIU, 2011:6, 12.

A group of 3 countries plus a state (South Korea, Gujarat State, India and Japan) have *developed* markets, but at this stage, not to the same extent as the UK and Australia. The next group of seven *emerging* countries in this field have established themselves in the PPP market, but appear to need to pay more attention to the category of *legal and regulatory frameworks*. In this 25% weighted category these countries have not scored as well as those countries above them. Some countries have taken legal and legislative initiatives in this area, but India and China have not addressed these problems in a significant way. The next highest weighted category (20%) is the *Institutional and Regulatory* Framework. South Korea, Japan and India score reasonably well in this category, but further progress is needed. China and Vietnam are in the lower scoring order for this category. Attention is needed in this and the previous category to lift its performance. Dispute resolution and legal delays are also areas that need attention. Appendix A provides detail of each country's scores.

CONCLUSIONS

The EIU *Infrascope* study (2011) identifies the importance of institutions to the successful implementation of PPP programs. Two features are particularly important for success in PPPs. Firstly, a formal PPP policy framework with the creation of a dedicated PPP unit within a central policy-making arm of government. Second, a pipeline of projects at national and sub-national levels is needed. Also important are the capabilities of the PPP unit which has an important role in facilitating and advising line agencies. The study highlights the central role of institutions in PPP policy and program success.

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APPENDIX A: CATEGORY SCORES BY COUNTRY

ASSESSMENT CATEGORIES												
25% WEIGHTING		20% WEIGHTING		15% WEIGHTING		15% WEIGHTING		15% WEIGHTING		10% WEIGHTING	
1. Legal & Regulatory Framework		**2. Institutional Framework**		**3. Operational maturity**		**4. Investment Climate**		**5. Financial Facilites**		**6. Sub-national Adjustment Factor**	
1. Australia	100.0	1. Australia	100.0	1. China	78.1	1. Australia	87.4	=1. Australia	94.4	1. Australia	100.0
2. UK	96.9	2. UK	100.0	2. UK	76.7	2. UK	82.3	=1. UK	94.4	=2. China	75.0
3. South Korea	78.1	3. South Korea	75.0	3. India	70.0	3. Gujarat State	80.0	3. South Korea	88.9	=2. India	75.0
4. Gujarat State	65.6	=4. India	66.7	4. South Korea	68.8	4. Japan	57.5	4. Japan	83.3	=2. Japan	75.0
		=4. Japan	66.7	5. Australia	66.5					=2. UK	75.0
5. India	59.4	=4. Gujarat State	66.7			5. South Korea	54.2	5. Gujarat State	77.8		
6. Japan	50.0			6. Japan	61.4	6. India	52.3	6. India	72.2	=6. Indonesia	50.0
7. Philippines	43.8	7. Thailand	50.0	7. Gujarat State	61.1	7. China	51.6	7. China	66.7	=6. Pakistan	50.0
=8. Bangladesh	40.6	=8. Indonesia	41.7	8. Thailand	50.9	8. Indonesia	50.3	8. Philippines	61.1	=6. Philippines	50.0
=8. Indonesia	40.6	=8. Kazakhstan	41.7	9. Indonesia	47.9	9. Thailand	48.6	=9. Kazakhstan	55.6	=6. South Korea	50.0
10. Pakistan	34.4	=8. Philippines	41.7	10. Philippines	44.8	10. Bangladesh	47.3	=9. Thailand	55.6	=6. Thailand	50.0
11. China	31.3	=11. Bangladesh	33.3	11. Pakistan	41.8	11. Mongolia	46.9	11. Indonesia	52.8	=6. Gujarat State	50.0
12. Thailand	28.1	=11. Pakistan	33.3	12. Bangladesh	41.0	12. Vietnam	46.4	12. Bangladesh	44.4		
						13. Philippines	46.3			=12. Bangladesh	25.0
=13. Kazakhstan	25.0	=13. Mongolia	25.0	13. Vietnam	25.5			=13. Pakistan	38.9	=12. Kazakhstan	25.0
=13. Mongolia	25.0	=13. China	25.0	14. Kazakhstan	15.7	14. Kazakhstan	43.3	=13. PNG	38.9	=12. Mongolia	25.0
15. Vietnam	18.8	=13. PNG	25.0	15. PNG	6.3	15. Pakistan	43.0	15. Vietnam	33.3	=12. PNG	25.0
16. PNG	15.6	16. Vietnam	16.7	16. Mongolia	3.1	16. PNG	17.7	16. Mongolia	13.9	=12. Vietnam	25.0

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EVALUATING TRUST AND RELATIONSHIPS AMONGST PROJECT PARTICIPANTS ON AN INDUSTRIAL PROJECT

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ABSTRACT

A construction project team requires a considerable level of blending of its project stakeholders for its successful accomplishment. Blending is derived from an environment that promotes trust and relationship between key team players otherwise the team dynamics could fail to meet desired project performance objectives. The research evaluates the effectiveness of such blending on an industrial project completed in Auckland, New Zealand in 2010. It collates opinions of supervisory level personnel of two key project organisations (client and construction management organisation) involved in the implementation of the project. The project organisations had operated under a traditional procurement system but within the framework of a blended team. Perspective opinions of the supervisory level personnel are used to determine the level of trust and interactions that existed on the project and how this could impact on project deliverables. The findings of this investigation will benefit all stakeholders in construction projects. It provides an understanding of the pitfalls to achieving inter-organisational relationships which may position future project teams for better performance and overall project delivery successes.

Keywords: blended team, construction project, interaction, project team, trust.

INTRODUCTION

There is evidence to suggest that trust between project stakeholders is critical to success on construction projects. For example, the focus of managerial practices has shifted from managing technical processes to focusing on psychosocial determinants of project performance. Although this trend tends to strain project management theory and practice (Chiocchio & Essiembre, 2009). Trust is one parameter of interest in psychosocial studies which could significantly influence performance. Ferrin and Dirks (2003) suggest that trust at both organisational and individual levels is an important element in all working relationships. Working relationships on the other hand impact on projects, because ideal project teams would work towards common objectives for successful project delivery. Thus trust is foundational to relationships (Smyth et al., 2010) and encompasses the behaviours of receptivity, nurturing and caring (Kadefors, 2005).

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The underlying concept is that trust is needed when risks and uncertainties are apparent and that risks are shared with other parties with an expectation of positive outcomes. Smyth et al (2010) explains that the presence of a trusted party helps to reduce perceived (interpreted or subjective) risks, renders relationships more conducive to risk reduction, and creates organisational and project opportunities to improve process and product. Similarly, Currall and Judge (1995) conceptualized trust as a behaviour that relies on another party under a condition of risk. Accordingly trust consists of two interlinked principles, reliance and risk (Currall and Judge, 1995).

Hannah's (1991) study was able to connect trust and construction project success criteria in terms of participant satisfaction (via the Minnesota Satisfaction Scale) and cost and schedule performance. Taylor et al (1977) also suggests that trust opens the lines of communication, helps self-understanding and the development of interpersonal relationships on projects. However, there are modest empirical studies that examine the nature of blended team working in construction projects without prior working relationships.

Therefore the primary objective of this study is to evaluate the relationship amongst project partners on a construction project and how this impacted on project deliverables. The evaluation was based on the trust model developed by Mayer et al (1995), which consisted of ability, benevolence and integrity, as the main factors perceived to boost trust within blended teams. Ability comprises skills, competencies, and characteristics that enable one party to have influence within some specific area on another. Benevolence implies the perception that a trusted party would have good intentions towards a trustor, aside from any egocentric profit motive. Finally, integrity is a trustor's perception that the trustee will adhere to a set of principles that the trustor finds acceptable. Other secondary or intervening factors that could influence the development of trust in projects include; Boundary Role Persons (BRPs), task conflict, role ambiguity and relationship conflict (Tidd et al., 2004; Simons & Peterson, 2000). However these factors are not analysed in great depth in the paper. Further details on the study approach, data collection and evaluation are provided in later sections.

BRIEF LITERATURE REVIEW

Issues of trust in blended teams on construction projects

Developing trust across blended teams could be difficult, because people frequently perceive individuals from other groups as less trustworthy than members of their own group. In other words, the aspirations, beliefs, or interaction styles of other groups may be seen as a threat to their own group goals (Fiske & Ruscher, 1993). According to O'Reilly et al (as cited in Jehn, 1995), two conflict types are characteristic of inter-organisational groups; task and relationship conflicts. Jehn (1995) explains that task conflicts (or cognitive conflict) derives from a perception of disagreements among group members about the content of decisions and involves differences in viewpoints, ideas, and opinions. Relationship conflict (or emotional conflict) on the other hand derives from a perception of interpersonal incompatibility which typically includes tension, annoyance, and animosity among group members.

It would seem that both types of conflicts between inter-organisations on a construction project are inevitable. Thus conflict is an issue to be expected and managed. Role ambiguity is not uncommon on construction projects, especially where blending for a uniform achievement of project objectives is necessary. Tidd et al (2004) also show that intrapersonal conflict could occur when a goal of an individual

is perceived as frustrated, or about to be frustrated, by another goal of the same individual. Therefore conflicts could arise when there is uncertainty about how one is evaluated, the opportunities for advancement, scope of responsibility, and expectations of others concerning work performance.

Simons and Peterson (2000) have noted that trust is an interpersonal factor that could moderate the link between the task and relationship conflicts. Thus individuals or groups with high levels of trust are less likely to make negative attributions concerning the intent of those engaging in task conflicts. They would respond constructively, accepting stated disagreements at face value rather than as if being attacked (Tidd et al., 2004). Thus empirical researches suggest that the higher the trust the weaker the correlation between task conflict and relationship conflict (Tidd et al., 2004).

To summarise, working in a blended team has inter-organisational benefits. Webber (2008) suggests that working in close proximities with frequent contacts is most likely to enhance interpersonal relationship. Blending operational teams increases the cross exchange of information and with boundary role persons there is every likelihood that trust levels will be appreciable. Although close proximity and mixing teams may be counterproductive in some situations, but largely blending should benefit intergroup and intragroup relationships.

Recognising the complexities of intergroup and intragroup relationships, the current study therefore intends to address questions that border on trusts and its impact within blended teams based on a case study project.

RESEARCH APPROACH

This study investigates the effectiveness of inter-organisational relationships amongst project participants involved in the construction of a NZ$120million industrial facility based in Auckland, New Zealand. Project participants on this case study project were constituted as a blended team made up of the client and a construction management organisation. This was the first time the team would work together to deliver a brown-field project for the expansion of an industrial facility. Staff of both organisations physically shared offices during the two-year (2008-2010) project duration and contributed to the project execution from the conception to the commissioning stages. The blended team configuration led to a unique operational experience, comprising many peculiarities of communication interflow, decision making abilities and trust.

To facilitate the study a conceptual framework was developed and structured around three key themes: ability, benevolence and integrity, the factors of perceived trustworthiness developed by Mayer et al (1995). A semi-structured questionnaire containing four key sections, which included demographic information and questions to cover the ability, benevolence and integrity themes, was administered to 16 senior project members from both the client and construction management organisations.

The questions were largely in the form of scales, rankings and open-ended types to provide clarity to the responses. The data obtained from the questionnaire is presented using simple interpretive and descriptive methods to make the findings communicative and understandable. According to McQueen and Knussen (2002), descriptive statistics are useful for describing, illustrating and summarising information in three ways, forming numbers into tables, generating charts and diagrams from the numbers, and then calculating general statistics. Some thematic correlation of the results was undertaken in order to explain agreements and disagreements in the responses obtained from respondents in the two organisations. In

concluding, the evaluation of the findings were synthesized in order to obtain a clear understanding of the inter-organisational conflicts that impacted on the blended teams' relationships.

A breakdown of the demographic information of the respondents is given in Table 1. Altogether 16 responses are used for the analyses with equal number of responses received from both the client and construction management organisation.

Table 1 – Profile of Respondents

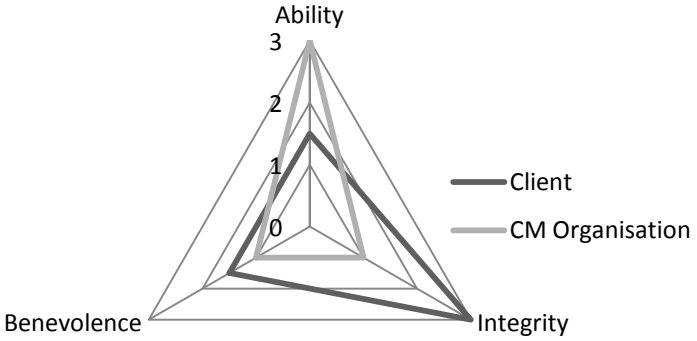
Organisation	Respondents	Number
Client	Project Manager	1
	Quantity Surveyor	1
	Contracts Administrator	1
	Electrical Engineers	2
	Mechanical Engineers	2
	Control Systems Supervisor	1
	TOTAL	**8**
Construction Management	Construction Manager	1
	Quantity Surveyor	1
	Design Engineer Manager	1
	Contracts Administrator	1
	Electrical Engineers	2
	Mechanical Engineers	2
	TOTAL	**8**

RESULTS AND FINDINGS

Trust between the client and construction management organisations

The three key themes: ability, benevolence and integrity developed by Mayer et al (1995), which are considered to be pivotal to trust between teams were determined from the respondents. Respondents were required to rank the three according to their level of priority, 1 being the least priority and 3 of the highest priority. A simple representation of their responses is depicted in the three-point radar diagram in Figure 1.

Figure 1 – Respondents' perception of ability, integrity and benevolence



On aggregation of the responses, members of the client organisation perceive integrity as the most important to trustworthiness amongst teams. Conversely the construction management team perceived ability as the most important in team relationships.

Members of the client organisation were of the opinion that ability and benevolence were equally important factors for the development of trust following after integrity. Whereas construction management team members considered integrity as the second important factor and benevolence as the least important factor.

The responses seem logical, wherein a client would expect its management company to adhere to certain set of professional rules and principles which would enable the achievement of their project objectives. Therefore the extent to which the construction management organisation actions are congruent with the client's expectations refers to the integrity which was perceived as being pivotal to trust by the client.

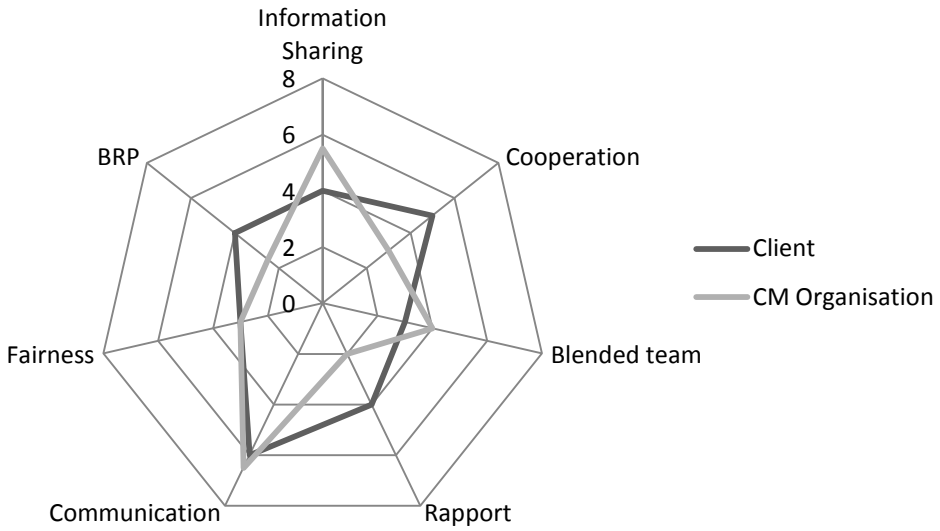
On the other hand, the construction management team members expect the client organisation to possess good level of skills, competences and personal attributes that will enable them work collaboratively in a blended team environment.

Trust development

The respondents were presented with a list of 7 factors that could facilitate the development of trust between them. The aim was to determine the level of importance ascribed to each factor by the two organisation members. Figure 2 gives a diagrammatic representation of the responses.

The findings show that communication was considered the most relevant factor for developing trust by both organisations. This is followed by information sharing and cooperation when all responses are aggregated together. However, cooperation is also an important factor for the client whereas information sharing is more relevant to the construction management company.

Figure 2 – Respondents' perception of trust development factors



Relationship conflict and trust

An aspect of the questionnaire sought to determine to what extent the level of trust is linked to relationship conflicts within these two organisations. The study found that task conflict was experienced by some members of the construction management organisation. Transcripts of two responses from the construction management organisation are included here to explain this. Both statements show that role ambiguity existed in the blended team environment which could lead to relationship conflicts.

My work responsibilities were not clearly defined

My work responsibilities overlap with the client's team responsibilities

Further, transcripts of the responses of two members of the client organisation are provided below.

Yes [relationship conflict exists]. Initial reluctance to include me in correspondence, meetings and discussions during early stages.

My impression was that by incorporating client's member the construction management team felt that we were spying the camp.

On the whole one could deduce positive team development using the blended organisational structure. Two transcripts from the construction management organisation are included in the paper to suggest the blending of the two organisations later on. As may be usual to any brown field project teams it takes time for parties to such projects to develop working relationships that could facilitate trust.

I had no problem working on a blended team. Generally the client's members were older and very senior members and normally specialist in their field. We would act in a supportive role. Often the client's member would say what was needed and we would get it designed and constructed. In similar circumstances I would think to do future projects the same way. [CM team member]

The blended team scenario, in the end, worked well. However, this was imposed over time and was not the original working model for the Contract. If this had been understood from the beginning, a better working relationship between the construction management team and the client's project management team could have been obtained" [CM team member]

Clearly, at the beginning of all projects, it is important that the groups develop and communicate the roles, responsibilities and expectations that they are to deliver. Trust cannot be developed when there is no framework for what role each group plays, so that expectations can be realised. Trust needs to be based on understood responsibilities rather than incorrect perceptions. This is of particular importance in project environments, where trust between team members is vital because many projects have uncertainty, complexity and constant change as daily challenges. Hence mutual trust is imperative. From an effective management point of view, the process of building trust should form part of management objectives.

Power and decision making

Well defined level of power and decision making abilities within a blended team environment should facilitate the interpretation of trust between inter-organisations. Therefore one aspect of the questionnaire addressed the level of power and decision making experienced by both members of the project. Members of the construction management organisation expressed that their level of power or influence was low and that decision making have been taken off them by the client organisation. For example they explain that costs and program decisions were exclusively managed by the client organisation contrary to initial contract terms.

Following these the second sub-question determined the extent that these level of trust links to the need for control and monitoring implemented by the client. The study found that trust levels for the construction management organisation was low hence the client had to implement higher control mechanisms. This situation led to arduous approval processes, closer supervision of construction management activities, and the client requiring frequent communication of results. It was observed by one of the

respondents that the client's involvement in the project (blended team strategy adopted) was a reflection of this poor level of trust.

DISCUSSION

The project was delivered under a traditional procurement system. Most of the work packages were tendered for competitively using familiar service providers with whom the client had long term working relationships (in some cases 20 years). The final contracts were negotiated with the service providers by the client. The original agreement was for the construction management organisation to manage the selection of service providers but this was reneged upon, probably because the construction management organisation had no prior working relationship with the client. There was an allusion of mistrust of the ability and integrity of the construction management organisation to manage the selection process.

The use of a blended team in this project led to a pronounced demarcation of authority and power. For example, key project decisions were made by the client and an arduous approval-supervision process reflected the authority status. Noticeably members of the project team from both the client and construction management organisations experienced role uncertainty, role ambiguity, duplication of work, relationship conflict, time delays and professional frustration. Members of the construction management organisation had indicated that they were constrained to contribute their knowledge and were unable to be more proactive to the project's decision process.

However during the course of the project, the construction management company gained the client's trust and an excellent working relationship was progressively established till the project reached completion. Personnel from the construction Management organisation had acquired the requisite technical skills. These positive benefits were achieved through the implementation of a blended team structure.

The findings demonstrate that trust is pivotal to construction project relationships and is greatly influenced by the level of communication amongst the project parties. All barriers to disclosure had to be taken down to allow trust to develop between these two parties.

CONCLUSION

This study investigated the effectiveness of inter-organisational relationships amongst project participants on the construction of an industrial facility based in New Zealand. The project participants were constituted as a blended team made up of the client and a construction management organisation who were working together for the first time. From the findings it was made apparent that initially there were several trust related issues on the project. But as the project progressed, task conflicts such as disagreements about decisions, and unclear construction management organisation's boundaries were resolved. Therefore the mistrust of the construction management organisation at the inception of the project gradually improved to the point of development of better levels of trust.

The findings are in consonance with various trust theories and models. Trust creates the opportunity for positive working relationships, resulting in improvement to fluent information flow. Supervision and control requirements are eased off since parties to a project could rely on the fact that project requirements will be met through committed performances. Overall trust provides a greater opportunity to achieve successfully managed projects.

Clearly, at the inception of construction projects, it is important that project participants develop and communicate the roles, responsibilities and expectations that they are to deliver. Trust could only develop when there is an operational framework that explains these roles and expectations, so that project deliverables become realizable. Trust therefore needs to be based on understood responsibilities rather than incorrect perceptions.

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ORGANISATION CULTURE INFLUENCE ON JOINT VENTURES SUCCESS IN SOUTH AFRICA

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ABSTRACT

Joint ventures among quantity surveyors in South Africa are said to be on the increase as organisations seek to be compliant with the Broad based black economic empowerment Act 2003. The Act was introduced with the view of correcting the inequalities of the past. There is a perception that joint ventures are marred with problems. The evaluation of the joint ventures in South Africa with emphasis on organisation culture is the focus of this paper. The study was conducted by analysis of responses from a survey questionnaire sent to the quantity surveying practices through the Association of South African Quantity Surveyors (ASAQS). The results indicate that organisation culture influences the success of joint ventures to a large extent, this finding was critical to the South African construction industry where partners from diverse background and culture have to form joint venture partnerships. The findings also confirmed that joint ventures among quantity surveyors in South Africa were often problematic.

Keywords: Joint ventures, organisation culture.

INTRODUCTION

Organisations find themselves operating in business environments where alliances are the most likely route to guarantee success. This is true in cases where an organisation wishes to enter new areas and then may have to penetrate the new markets quickly before best partners form relationships with competitors. It is also prevalent when entering new markets abroad where local knowledge may be invaluable.

The other advantage of organisations developing alliances is that they may have access to a large pool of resources. Sometimes it is ideal when organisations have different forms of expertise and by sharing a pool of resources they enhance their capabilities and are able to meet their client's expectations.

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Alliances in some instances dilute the risk for each partner and some stakeholders may prefer this as a way of spreading their financial risk. In the South African context the Broad-Based Black Economic Empowerment Act also called the B-BBEE Act (53/2003) was passed to promote black economic empowerment. The introduction of the Act resulted in an increase in joint venture partnerships among professional quantity surveying practices as they sought to comply with the codes of the Act.

The aims of the study was to determine the extent to which joint ventures are successful in South Africa and also to determine the extent of organisation culture influences on the success of joint venture partnerships.

Joint ventures in South Africa

Organisation culture plays an important role in the relationship of joint venture partners. When different organisations with different cultures developed over years are placed to work in different environments, it may exercise considerable strain on the relationship and subsequently on the success of the project.

Bresnen and Marshall (1999) highlighted cultural alignment as a prerequisite for collaborative working, where organisations shared basic values, attitudes and beliefs and the need for some form of compatibility between organisations. In the absence of compatibility, organisations should change their ways of working. They describe culture as consisting of a system of shared meanings based on common values and beliefs held by members of an organisation.

Elashmawi (1998) outlined some causes of corporate culture clashes as a clash between profit-oriented organisations and socially oriented partners. However, his study points to the executives in multicultural joint ventures being preoccupied with business needs such as raising capital and establishing operational plans but paying less attention to cultural issues that influence the joint ventures day-to-day operations. Yet these are the cardinal issues that can make or break a joint venture operation. The findings of Elashmawi's survey (1998) established that the inability to manage cultural diverse employees leads ultimately to poor performance and reduced revenues.

The South African construction industry, with its historical background of different races and cultures, faces challenges in managing joint ventures, especially if the partners are from diverse backgrounds. Elashmawi (1998) presents a multicultural management process, which could be applied to joint ventures with members who come from diverse professional and cultural backgrounds. The process begins by surveying employees' individual needs during their daily activities. This is followed by seminars, group discussions, presentations and case studies. This would include cross-cultural discussion and team building, where participants point out their strengths and weaknesses. This exercise culminates into participants identifying their core values. The comparisons of the core values help develop action plans to build on corporate strengths and minimise corporate weaknesses. Subsequently, a new culture is created among members. Conflict is overcome through compromise and the implementation of corporate goals that satisfy the multicultural business needs of each joint venture partner. This process is supported by Cheng et al. (2004).

Managing multicultural joint ventures can be challenging. The drivers in the collaboration should understand the intricacies that may be encountered in the day-to-

day operations. Once the structure of the joint ventures is established, a model is developed. Bresnen and Marshall (1999) highlight the potential conflict between commercial pressures and forms of collaboration in practice and the inherent difficulties in attempting to change organisational cultures to support collaborative approaches of working. Al-Khalifa and Peterson (2002) cited compatibility at operational level as the key to the success of the alliances requiring alliance partners to achieve a strong interpersonal relationship that transcends across cultural differences and backgrounds. This is supported by Makino and Beamish (1998), who found that multinational partnerships provide a higher opportunity for superior performance but have a higher likelihood of termination while domestic joint ventures provide a greater opportunity to achieve a superior performance and had a lower likelihood of termination.

The study

Quantitative research design was the most appropriate method to be employed in the study. A questionnaire survey was conducted among professional quantity surveying firms to provide answers to research questions. There are approximately 750 practicing quantity surveying firms registered with the Association of South African Quantity Surveyors which formed the target population. The unit of analysis is, quantity surveying firms. There were a total of fifty (50) respondent firms, registered with the Association. There were no specific geographical requirements all registered firms had an equal chance of being in the sampled group.

The sample population was limited to legally registered firms with email facilities. A non-probability sampling was used to obtain a reasonable sample that would be representative. According to Bartlett, Kotrilik and Huggins, (2001) the minimum sample size required from a population of 750 with a 3% margin of error were 161. However, due to anticipated low responses experienced with questionnaire surveys the sample size was increased to 250 which translated to 55% more than required. The percentage response rate was 20% which was deemed to be adequate. (see table below)

Table .1: The number of questionnaires sent and responses received

Survey responses	**Quantity**
Sampling frame	250
Required sample	161
Questionnaires sent	250
Number received	50
Usable	50
% usable response rate	100

The questionnaire consisted of the 5-point Likert rating scale. The responses would enable the measurement of the intensity of the respondent's perception of the working of joint ventures. The respondents were required to state how they felt about a statement whether they strongly disagreed, disagreed, were neutral, agreed or strongly agreed. Due to restricted space the questionnaire is not included in this article.

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The responses were then statistically analysed and interpreted, and the findings were outlined based on the data collected. A descriptive statistical approach was used in the analysis and presentation of data. The comments by the respondents were interpreted and the interpretations are provided below each section of the questionnaire. The following statement was analysed and the findings presented in the report:

- The extent to which organisational culture influences the success of a joint venture partnership?

Conclusions were drawn from the findings and recommendations were made in order to answer the research questions.

The survey results indicate that 52% of the respondents stated that organisational culture was a major cause of problems in a joint venture, 21% disagreed, while 27% were neutral. On the question of organisation culture influence the survey results indicate that 88% of the respondents agreed that organisational culture influenced the success of joint ventures, 4% disagreed and 8% were neutral.(see figure 2)

Figure 1: Organisational culture

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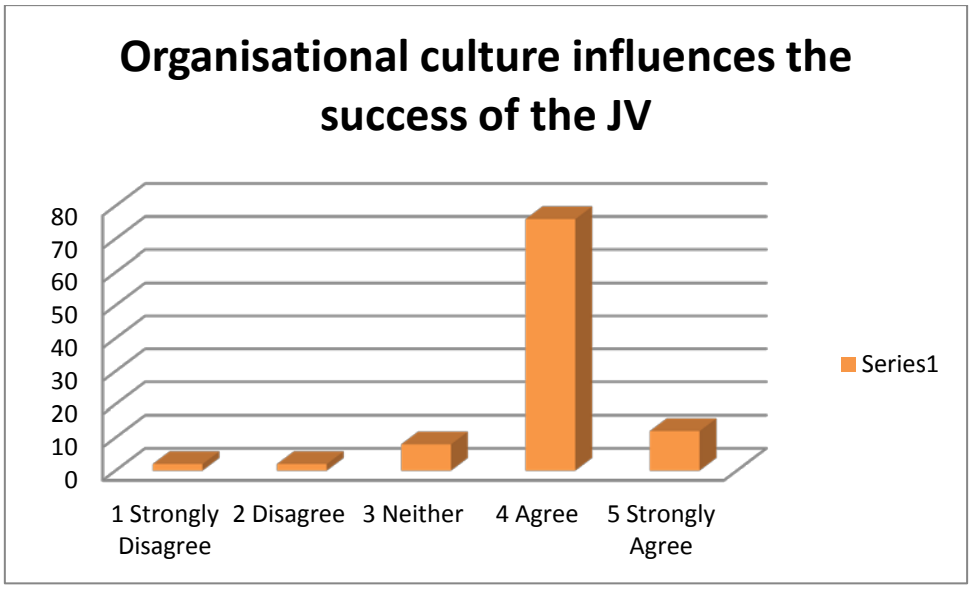

Figure 2: Organisational culture influences the success of a joint venture

On the application of multicultural management process applied in joint ventures when partners come from different cultural backgrounds. The results of the survey indicate that 46% of the respondents agreed that a multicultural management process should be applied in joint ventures when cultural issues arose, 14% disagreed and 40% were neutral. The respondents also agreed that cultural alignment should be a prerequisite for joint ventures. It was also found that executives paid much attention to cultural issues that influence day-to-day operations of a joint venture. These findings are very important since South Africa is composed of people from diverse backgrounds, which could adversely affect the working and success of a joint venture. The respondents agreed that the aspect of race and cultural background could not be ignored in a joint venture working environment in South Africa. The results indicate that 46% advocated the use of a multicultural management process when dealing with partners from different backgrounds. The findings fully support the earlier study by Bresnen and Marshall (2000). Bresnen and Marshall (2000) stated that cultural alignment should be a prerequisite for joint ventures where organisations share basic values, attitudes and beliefs and there should be compatibility between organisations, sometimes referred to as partner fit. It is interesting that the study points to compatibility as a key factor. In the same study, when reviewing the results of partner selection and rankings of key factors, the findings for the South African construction industry indicate that compatibility was the most important factor in partner selection and the results indicate that 90% of the respondents indicated compatibility as a key factor.

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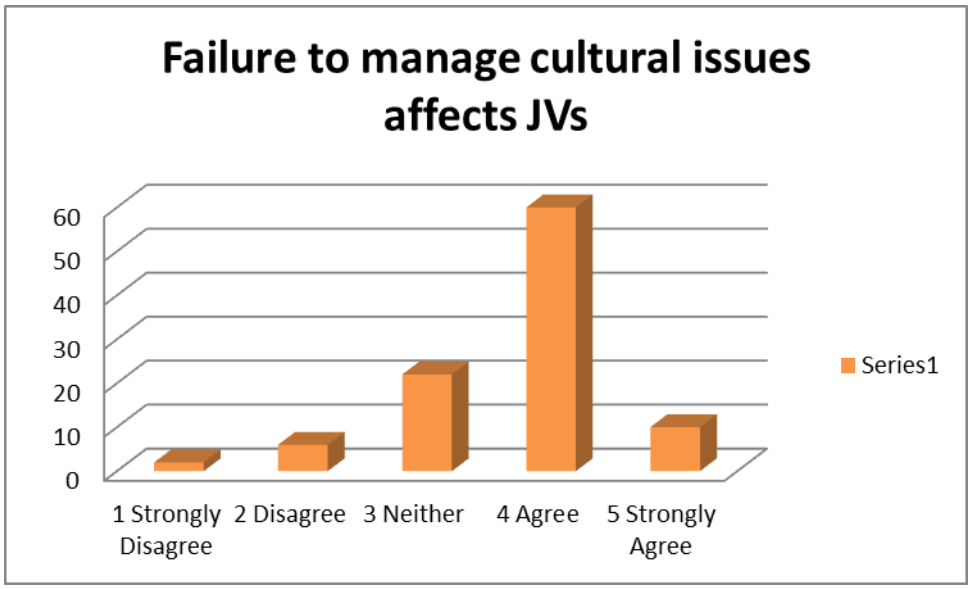

Figure 3: Failure to manage cultural issues affects joint ventures

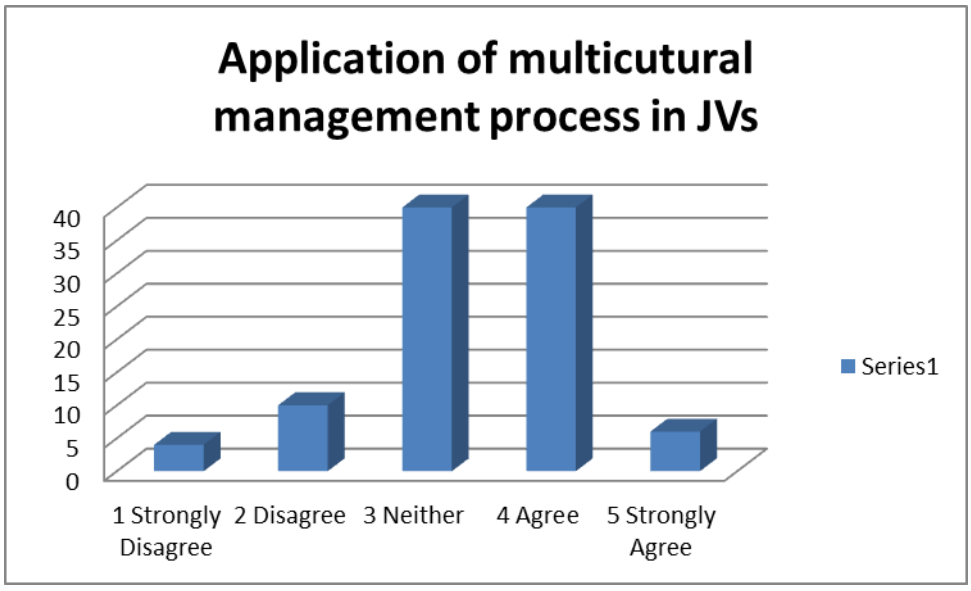

Figure 4: Application of multicultural management process in joint ventures

The findings indicate that to a large extent, organisational culture influenced the success of joint ventures, though less than half advocated the use of a multicultural management process to deal with matters of cultural difference. The results support the statement that organisational culture can influence the performance of a joint venture. The findings also support the research question on whether joint ventures were marred by problems.

CONCLUSION

The study results indicate that although problems were encountered, the partners in a joint venture were focused on delivering a product for the client. Compatibility was seen as a critical factor for consideration in joint ventures. Organisational culture was seen as an important factor that could adversely affect the joint venture relationship. The survey highlighted the major causes of problems and organisation culture. Careful evaluation of culture differences should be undertaken. It is recommended that further research is conducted on the development of a model that can be used for evaluating a culture differences in an organisation.

RECOMMENDATION

Upon establishing that there are organisational cultural differences, the partners should identify ways of working together with diverse views, beliefs and objectives. This can be achieved by the use of workshops and team-building exercises prior to commencing the joint venture activities.

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OVERCOMING THE BARRIERS TO INNOVATION IN PPP/PFI PROJECT-BASED ENVIRONMENTS

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ABSTRACT

The mainstream literature of the concept of innovation is vast. So far the discussion on innovation has presented views from multiple disciplinary backgrounds of which it can be complementary to improve the understanding of innovation and it can as well lead to more confusion. Innovation in project-based organisations is a major challenge especially in PPP/PFI projects. The main barriers identified in the literature are: a) the one-off nature of projects; b) the configuration of construction work; c) lack of joint collaboration; and d) the challenge of managing innovation. One important aspect of the innovation process is the need for the innovating system to gather information and transmit same to several external information areas across organisational boundaries. But, there is paucity of research that has demonstrated how project-based organisations can influence innovation in construction projects. This is the main challenge of this research to examine empirically the factors that support innovation and to understand how project-based organisations innovate. So that project managers and decision-makers can relate to in order to encourage sustainable innovation in projects marks the point of departure of this research work. To achieve this objective a questionnaire survey was designed and distributed among PPP/PFI practitioners in the United Kingdom based on the likely factors identified in the literature to influence PPP/PFI innovation. Also, three case studies were examined. The findings are evenly replicated and it suggests that to influence innovation in project-based environments: a) interpersonal ties formed are very important; b) networks of learning; c) network governance; d) organisational capabilities; and e) joint collaboration between clients, suppliers, manufacturers and researchers are very crucial. The findings have considerable significance to construction practitioners and managers on how to overcome the barriers to innovation.

Keywords: Collaborative networks, Innovation, Project-based organisation, PPP/PFI.

INTRODUCTION

It is without a doubt that the UK construction industry is suffering its worst recession for 100 years of which banks have virtually stopped lending to construction companies and this have impacted on delaying vital payments on projects (Harding, 2010). However, it is well documented that the integration of innovative approaches in construction projects is a better way to improve the construction industry performance (Egan, 1998). Although, improvements have been achieved after the

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Egan report, but there is still shortfall in practice as the 30 per cent target in project savings has yet to materialise (Smyth and Olayinka, 2010).

It then suggests that more research is needed to improve understanding of how to stimulate innovation within established construction methods and processes to improve project performance. The starting point is for the organisation to: a) identify the need for the innovation; b) to establish and maintain effective and efficient innovation process; and c) to provide or acquire the related resources to enable its implementation and application (BSI, 2009). Innovation should not only focus on reducing cost, time and to improve quality but also on achieving a low-carbon future through the use of sustainable building materials. Nevertheless, the temporary and unique nature of project-based organisations can pose a hindrance for the integration of innovation in projects been delivered.

Furthermore, the discussion on innovation has presented views from multiple disciplinary backgrounds which can be complementary to improve the understanding of innovation and can as well lead to more confusion. In a similar vein, Galanakis (2006) noted that several theories have been developed on how innovation occurs in an organisation and which factors affect the outcomes of this process. But, argued that these theories come from different perspectives that focus on management, economics or social sciences and create a complex net that makes managers take decision that the outcome of which contradicts their original objectives. Overall, the literature on project-based innovation in construction is limited. The main challenge of this paper is to investigate empirically the factors that support innovation although varied initiatives to stimulate innovation have been identified in the project-based innovation literature; project-based organisations are limited by the short term focus of participating organisations to initiate or stimulate innovation.

KEY ISSUES IN THE INNOVATION PROJECT-BASED LITERATURE

In the construction literature, Thomas and Bone (2000) identified three key areas for innovation activity that "can deliver significantly improved quality and value as: a) supply chain management and partnering; b) value and risk management; and c) technical innovation (p.67). Based on a substantial literature review of project-based innovation, Keegan and Turner (2002) found that the strict over-reliance on project control and evaluation methods often appears to suppress innovation. Furthermore, innovation is seen to be risky, costly and often dangerous to implement. On the other hand, Gann and Salter (2000) had earlier argued that project-based organisations are only able to harness and reproduce their technological capabilities when they integrate or link non-routine project processes and routine business processes.

But, Acha et al., (2005) argued that the challenge several project-based organisations face is how to manage the interaction between temporary actions and repetitive business practices such as innovation that provide the means in which projects can thrive. Therefore, it suggests that innovation in project-based organisations is more becoming episodic in nature. For this reason, there is a strong need for project-based organisations to stimulate innovative ways to improve their project performance.

On the other hand, to significantly encourage innovation, Blindenbach-Driessen and van den Ende, (2006) found that the success factors for functionally organised firms, as described in the literature seem to be more important in project-based firms but others appear redundant. For example, the application of contingent planning

approaches and the availability of sufficient experts. But the use of cross-functional teams, experienced project managers, and cooperation with customers, suppliers and market researchers are important in project-based innovation process.

But, the view of Whitley, (2006) suggest that project-based organisations differ considerably in a number of ways, particularly the singularity of their goals and outputs and the distinctiveness and stability of work roles and task organisation. It implies that the temporary nature of project-based organisations obstructs the possible development of any distinctive organisational or technical competencies to improve future project performance. To practically influence innovation, collaborative learning and knowledge creation are significant ingredients to sustain creativity for competitiveness (Nonaka, 1994). The challenge for project-based organisations is how to identify organisations with requisite capabilities and knowledge to collaborate with to create valuable products.

Nevertheless, Aouad et al., (2010) discover that innovation, whether at an international, national, regional, firm or project level of analysis, continues to be at the forefront of the mind of policy makers and practitioners alike. Yet, their understanding of innovation is far from complete. They also suggested that more research is required to study innovation at these different levels of resolution and at different points in the project life cycle. In order for the research base to play its part in promoting construction innovation, an engagement mechanism is required that brings together academia and industry in a way that recognises and responds to these multiple perspectives on innovation.

Overall, innovation is found fundamental to improve the performance of the construction industry, but understanding innovation process, how innovation can be enhanced and how it can be measured are key stages to facilitate innovation (Gambatese and Hallowell, 2011). Hence, it is imperative to identify the significant factors that can enable innovation within project-based environments. This study builds on previous studies conclusions on the barriers of innovation, which suggested that the discontinuous nature of project-based production and the configurations of construction work, with divisions between disciplines and organisations is a major obstruction to attempts to initiate new innovations and initiatives within project-based environments (Gann and Salter, 2000; Harty, 2005). However, the literature identified a number of means to stimulate innovation within project-based environments such as: a) technical support of construction practitioners' such as providing training can be a useful means to stimulate creativity (Eaton et al., 2006); b) capabilities need to be accumulated from project-to-project (Bayer and Gann, 2007). The construction literature similarly identified several factors to deliver innovation in construction organisations. The study conducted by Miozzo and Dewick (2002) suggested that inter-organisational cooperation can be a useful means to improve construction innovation. Furthermore, subsequent studies suggested that construction innovation process depends on how knowledge management activities are integrated (Manley, 2008) to stimulate innovation. Nevertheless, the longetivity of projects been delievered by project-based organisations is a key impediment to the recommendations researchers present on how to initiate innovation. Therefore, most academic papers provide little on how to effectively overcome the barriers to innovation within project-based environments. In addressing this concern, there is a strong need for construction and project management practitoners to continuously advocate inter-organisational collaboration for knowledge transformation to improve construction processes.

RESEARCH METHODOLOGY

The main objective of this paper is to identify the appropriate means to successfully stimulate innovation from the perspective of PPP/PFI practitioners working within the PPP/PFI framework in the United Kingdom. Through this approach, the research sought what factors are suggested by practitioners and how the factors can play a significant role to sustain continuous innovation in construction. To achieve this objective, the research used a structured approach in administering questionnaires and case studies on-going projects. The quantitative data provides insight into the views of PFI practitioners involved in on-going PFI projects on critical factors that support innovation and then qualitative data was necessary in order to confirm the factors. Interviews were used to gather information/data on key factors that stimulate construction innovation.

The main project partners were interviewed. These are: a) project clients, b) construction firms and c) project financiers. Interviewees are working for three separate consortiums formed to deliver three different Building School for the Future schemes in the United Kingdom. Overall, seven people were interviewed and the questions are semi-structured. These interviews took approximately one hour for each interviewee. Also, a total of 200 questionnaires were distributed to both public and private organisations representing organisations known to be involved in PFI projects via e-mail and postal mail. A total of 66 completed questionnaires were returned giving a response rate of 33 per cent. Factor analysis technique was chosen as a means to achieve the paper's objective with the help of Statistical Package for Social Software (SPSS), to capture cluster of relationships within a number of variables.

RESEARCH RESULT

The paper identified thirteen (13) essential factors to stimulate project-based innovation. Table 1 shows the ratings of PPP/PFI practitioners on the factors to significantly stimulate innovation within PPP/PFI project-based environment. Table 2 shows the factor loading after rotation. Factor loadings with an absolute value greater than 0.5 was interpreted and Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis, KMO = 0.763 and the values of MSA are reasonably high; this ranged between 0.672 - 0.870 except for one variable that is 0.323, apart from that variable the variables are well above the acceptable limit of 0.5 (Field, 2009). Bartlett's test of sphericity x^2 (78) = 359.862, $p < .00001$, indicated that correlations between items were sufficiently large for factor analysis.

Table 1 PPP/PFI practitioners' views of enablers of innovation in PPP/PFI projects

Factors	Private Sector respondents Severity Index	Public sector respondents Severity Index	Category Ranking (Private Sector)	Category Ranking (Public Sector)
Interpersonal and informal networks of learning	73.33%	81.94%	8	6
Formal exchange of knowledge	72.35%	77.78%	9	8
Informal exchange of knowledge	75.61%	76.39%	6	9.5
Joint working team	86.18%	86.11%	2	1.5
Decision making process	79.67%	86.11%	4	1.5
Joint governance structure	61.67%	76.39%	12	9.5
Relevant human resource expertise	73.98%	79.17%	7	7
Incentive policies	64.23%	63.89%	11	13
Diffusion pattern of new idea	61.40%	71.01%	13	12
Trust	88.03%	86.11%	1	1.5
The degree of connectedness between partners	82.50%	83.33%	3	5
Strength of individual, firm and network direct ties maintained	76.67%	76.39%	5	9.5
Strength of individual, firm and network indirect ties maintained	71.05%	72.46%	10	11

Table 2 Rotated Factor Matrix for factors to stimulate innovation within project-based environment
CASE STUDIES ANALYSIS

Factor label	Influential Factors	Code	Factor loading
Factor 1: Interpersonal ties	• Strength of individual, firm, and network direct ties maintained	ToPromIn3L	0.941
	• Strength of individual, firm, and network indirect ties maintained	ToPromIn3M	0.735
Factor 2: Collaborative working	• Joint working team	ToPromIn3d	0.551
	• Relevant human resource expertise	ToPromIn3g	0.590
	• Trust	ToPromIn3j	0.667
Factor 3: Networks of learning	• Interpersonal and informal networks of learning	ToPromIn3a	0.701
	• Informal exchange of knowledge	ToPromIn3c	0.617
Factor 4: Network governance	• Joint governance structure	ToPromIn3f	0.970

Interpreting Patton (2002, p.244), 'there are no rules for sample size in qualitative inquiry it depends on what you want to know, what will be useful, what will have credibility, and what can be done with available time and resources'. The case studies analysis on approaches to overcome barriers to innovation is focused on three BSF schemes: a) Leeds, b) Manchester and c) Blackburn with Darwen. To understand how project-based organisations innovate. The interviews conducted provided some interesting details. First and foremost, organisational capabilities were found to be very significant in any innovation process by the project-based partners.

In this paper, organisational capabilities refer to having the right people with the right knowledge. In order to improve the operational performance of the schools, the project client at Blackburn with Darwen BSF scheme points out that the brief for all the schools projects as a priority the design quality most achieve life sustainability to reduce maintenance cost. However, the project client explained that the standard LEP construction supply chain model may limit innovation because of the processes that are imposed. In a similar vein, one of the project partners at Leeds BSF identified the rigidity of the BSF framework as one of the factors that hinders innovativeness.

Second, one of the interviewees at Leeds BSF highlighted that a number of Head Teachers and Local Education Authorities do not want buildings that are absolutely new and untested. However, the led construction organisation at Leeds BSF scheme was of the opinion that within project-based environments innovation comes when the whole project partners have sufficient time and the scope of the innovation is affordable. Third, also the BSF project client at Manchester believed that innovation in building products is very slow in the United Kingdom but so far most of the innovations are for products that are very expensive and the payback period are very long.

It is clear that still a lot of work has to be done to effectively stimulate construction innovation within project-based environments; it is not surprising that there is growing need for new approaches and concepts to practically integrate innovation within projects delivered by construction organisations. Since, it is expected that the integration of innovation can enhance project performance. To achieve this will require different organisational capabilities.

Overall, the identified major innovations found in the BSF schemes investigated are process innovation such as standardisation of specification and new projects approval process aligned with (Royal Institute of British Architects (RIBA). On the other hand, innovation that has to do with new product development was less visible in the schemes. It then suggests that PPP/PFI project-based organisations struggle with the issue of innovation. However, it is important to note that the projects investigated: a) Leeds, b) Manchester and c) Blackburn with Darwen BSF schemes are judged to have performed well in the schools delivered. All the respondents suggested that: a) innovation is stimulated when you have the respective project-based teams' collectively working together; b) forums to enable the generation and transformation of knowledge and c) human and resource capabilities to stimulate innovation to create value.

DISCUSSION OF FINDINGS

Findings from the questionnaire survey and views summarized in this paper raise discussions about how to overcome the barriers to innovation within project-based environments. Previous studies have suggested that to stimulate product or process

innovation it is crucial that collaborative relationships are maintained (Reichstein et al., 2008). In a similar vein, the study by Eaton et al., (2006) strongly suggested that collaborative relationships with the external environment are important to access information and appropriate facilities. Also, the study by Miozzo and Dewick (2004) was able to demonstrate the significance of inter-organisational networks to stimulate innovation. A missing link in most studies is how to stimulate innovation and what factors are significant in the innovation process. This is the contribution of this paper.

The interpretation of the results provides potential answers. From both studies conducted, a) maintaining interpersonal ties with research institutions, clients and manufacturers b) advocating long-term collaborative relationship; c) networks of learning to provide means to gather and transform knowledge and d) network governance to provide means to control and manage the networks relationships are identified as appropriate means to support innovation. The practical implication here for project-based organisations is that when they embed themselves in collaborative networks it increases their access to new knowledge and provides a means for learning to improve their projects. The BSF schemes investigated demonstrated that collaborative relationships that are long-term focus provide better means to initiate innovative approaches within project-based environments. The standardization of building products and the new programme approval process are examples. Also, the findings of this research suggest that PPP/PFI project-based organisations are no different from other project-based organisations regardless of the project structure.

CONCLUSION AND IMPLICATIONS

Based upon the research results, we have described and identified how project-based organisations can stimulate construction innovation. The paper has demonstrated that project-based organisations working within project-based environments struggle to initiate product innovation as the short-term focus of participating organisations and the working contractual frameworks with which they use hinder their drive to innovate. It is worth emphasizing that if project-based organisations establish and develop collaborative networks their collective project knowledge can be gathered to create valuable products which can be used to improve their subsequent projects. The network can serve as a learning hub for the creation of new ideas. The practical implication for project managers and construction practitioners is that the network approach provides a significant means to enhance their creativity through knowledge sharing leading to the building of organisational capabilities.

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PITFALLS IN OUTPUT SPECIFICATIONS FOR PUBLIC PRIVATE PARTNERSHIP PROJECTS AND THEIR SOLUTIONS

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ABSTRACT

Public Private Partnerships (PPP) has grown very rapidly in the last couple of decades for the procurement of infrastructure and municipal services. These services are procured using output specifications, which stipulate the output-based requirements of clients and also cover issues such as physical asset, facilities, level of service, change mechanism, performance criteria linking payment mechanism and risk allocation. Output specifications are considered an integral part of contract documents for PPP projects but pitfalls abound in the drafting of output specifications. Well designed and structured output specifications not only provide an opportunity to the private sector to offer innovative and cost effective solutions to the client but can also minimize future conflicts arising from PPP contracts. Value for money can only be achieved with careful drafting and enforcement of output specifications. An examination was undertaken on the roles of output specifications in the PPP process, together with their features and common pitfalls, through a study of examples. Solutions were recommended to avoid the pitfalls.

Key Words: PPP/PFI, output specifications, pitfalls, solutions, change management.

INTRODUCTION

Public-private partnerships (PPPs) have attracted wide interest around the world (O'Flynn and Wanna 2008) and have grown rapidly in the last couple of decades (Doloi and Jin 2007; Regan et al. 2011). PPPs have been used in more than 85 countries around the world for procuring social and economic infrastructure projects (Regan et al. 2009). PPP procurement strategy is still expected to be a major procurement route in the foreseeable future (RICS 2011). One of the prime motives of governments launching PPP projects is to shift the life cycle risk to the private sector (Chan et al. 2010) while achieving value for money through effective and robust output specifications (KPMG 2010). PPP contracts are based on an output specification approach and an output specification is considered an integral part of the bidding documents for PPP projects (Department of the Environment and Local Government 2000). The output specifications articulate the public sector client's required standards of services whilst the private sector chooses how to meet and possibly improve upon these standards (Iossa et al. 2007). They also delineate

responsibilities (as a means of risk allocation) between the public sector client and private sector operator (Lam 2007). A well drafted output specification is fundamental to developing a robust PPP/PFI contract and the successful delivery of long term asset and services (4Ps 2005; Sanders and Lipson 2001).

The main advantage of PPPs is to deliver value-for-money, which takes some efforts to achieve and the most important value-for-money drivers are the transfer of risk, the output-based specifications, the long term nature of contracts, the performance measure, the increased competition and the private sector management (van Herpen 2002). However, experience has shown that they may sometimes go wrong resulting in failures for PPP projects which have happened around the world and in some cases it was because of shortfalls in specifications or unclear contractual obligations and poorly designed contracts (Iossa et al. 2007). For example, there have been instances where contractual deductions for poor performance were insufficient to make the private sector agile (e.g. the London Underground case), or where the contract omitted to specify what should be conditions of the facility before the contract expired (Iossa et al. 2007). Due to the long term nature of most PPP contracts, mistakes at the initial contract drafting stage can lead to very high cost for the public sector client (Iossa et al. 2007). In this paper, the features, prospects and pitfalls of output specifications for PPP/PFI projects are discussed, focusing on the impact of these pitfalls on the performance of PPP projects. Of particular interest are the various problems related to the development of output specifications. Solutions are proposed to avoid possible problems in the project life cycle by careful drafting of output specifications for PPP/PFI projects.

OUTPUT SPECIFICATION FEATURES

Output specifications stipulate *what* services are to be delivered rather than *how* they should be delivered in order to maximize the opportunity for innovation from the private sector contractor (Cartlidge 2006; Infrastructure Australia 2008). Akintoye and Beck (2009) argued that good output specification clearly states the client's requirements and reduce the possibility of disputes in the later operational phase of PPP/PFI projects. Writing a clear and effective output specification is a very difficult and skillful job (Lam et al. 2010). McDowall (1999) opined that the output specification has changed the attitude of specifying building and service requirements, concentrating on the performance aspects which are important to clients. Output specifications contain aspirations, aims, objectives, purpose, scope, performance requirements, and also address standards of compliance, constraints, risk allocation, hand-back requirements, etc. and encourage alternative or innovative solutions (HM Treasury 1998). Payment mechanism is also an essential part of PPP projects and is linked to the performance standards to be achieved by the private sector. Performance standards are necessary for ensuring the delivery of outputs to client's requirements. Some particular performance standards may not be easy to define in output terms; a technique of *equivalence* can be adopted (HM Treasury 2003). To monitor these performance standards, the client specifies key performance indicators (KPIs). Some of the KPIs may be onerous to achieve by the contractor. The following Figure 1 shows the relationships between service requirements set out in the output specifications, the performance framework, the payment mechanism, and the contract monitoring regime.

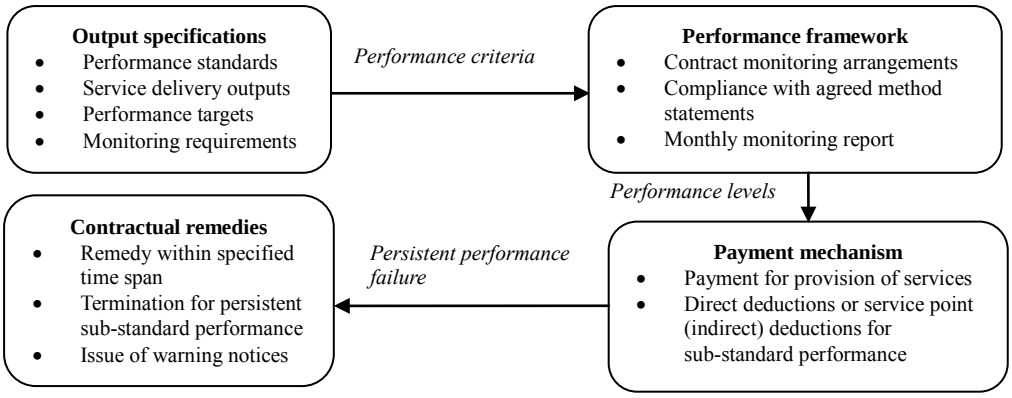

Figure 1 Relationship between output specifications, the performance framework, the payment mechanism and contractual monitoring system (Source: adapted from 4Ps 2007).

Figure 2 shows that the most frequent reason for disputes in PFI projects as surveyed in the UK is over interpretation of contracts and the second frequent reason is poor performance, quality of service and output specifications.

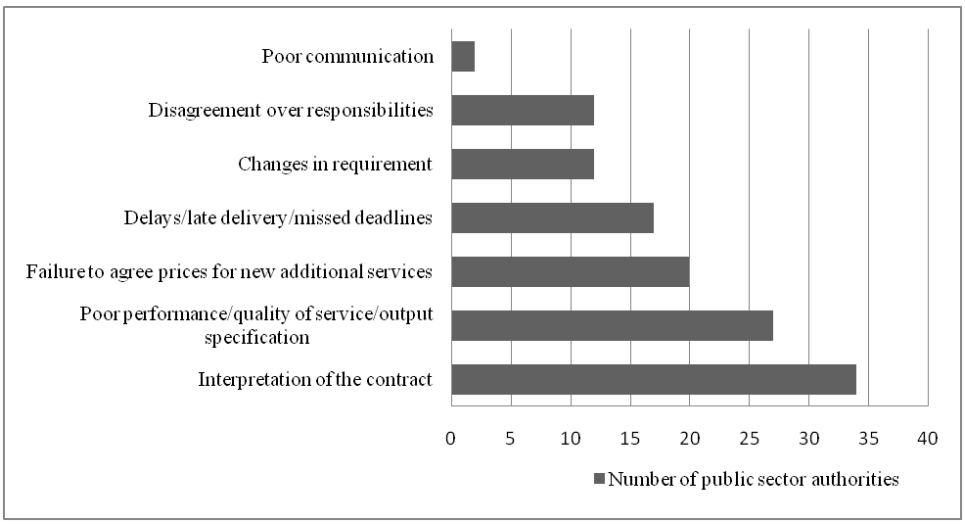

Figure 2 Main reasons for disputes in UK's PFI projects (Source: National Audit Office 2001).

Changes in client's requirements and legislation/regulations also affect PPP/PFI projects. In school and hospital PPP/PFI projects, core services are not part of output specifications (e.g., clinical services, teaching/education services are provided by the public sector) and if there would be any change in the core requirements it can ultimately affect the facilities management services specified in the output specification (Robinson and Scott 2009). Negotiations for large changes after financial close are rather difficult to achieve because the lenders need to be involved (Edward et al. 2004; Partnerships UK 2006).

POTENTIAL PITFALLS IN OUTPUT SPECIFICATIONS AND THEIR SOLUTIONS

Although standard output specifications are being developed and used in mature PPP markets such as the UK and Australia, not much literature addressed potential pitfalls in output specifications and provides solutions on problems arising. There is still a great deal to learn from the pitfalls inherent in output specifications. Due to the long term nature of PPP concessions, the user requirements evolve over time and there is a

risk that the output specifications agreed in the initial contract stage become inadequate because of changes in technology, policy and society preferences, etc. (Iossa et al. 2007). The parties involved are bound for a period of 20-30 years which also reduces flexibility (Alexandersson and Hultén 2007). This lock-in situation may sometimes be exploited tactically by the private counterparts for renegotiations (Hoff 1994; Williamson 1983). The common legal term '*fitness for intended purpose*' seems to be very comprehensive, but can be misinterpreted by the private sector contractor. The fitness for purpose of the project should be aligned with the client's mission statement and the facilities must be appropriately maintained by the private sector and where necessary upgraded to ensure that it continues to be fit for its intended purposes throughout the concession period (Chew et al. 2005).

To cater for future changes in the user requirements, flexibility should be made in the output specifications (Addleshaw et al. 2006). It was found in an inquiry into contractor's performance that a major reason for user dissatisfaction with a number of PFI school refurbishment projects was its output specifications. A spokesman for the Public Private Partnership Programmes (4Ps) pointed out that there was a gap between user expectations of what the output specifications would deliver in terms of quality and what was actually delivered. It was concluded that *"the output specification be replaced with clear input specification in all schools PFI refurbishment projects in the future"*. Most contractors prefer the use of input specifications because everyone will know exactly what is expected and what to deliver (Carol 2003), apart from the retention of design liability by the specifiers. In the case of cleaning in hospitals, it is difficult to describe outputs in contractually effective ways, which are consequently difficult to monitor (Edward et al. 2004). Examples of potential problems of output specifications and their solutions as extracted from the literature are shown in Table 1.

Table 1 Examples of pitfalls and their solutions for output specifications of PPP/PFI contracts

Possible problems	Proposed solutions
• Client unclear about the vision, scope, objectives, aspiration and requirements. • Client's objectives may conflict with each other. • Subjectivity of output specs which permits different interpretations of acceptable standards such as disagreement over the meaning of *clean* is often vague. • Miss-interpretations and different interpretations of contract documents. • Output specs often repeated the following subjective terms (Radford, 2001): - *minimum mechanical ventilation for the building;* - *minimum solar gain to avoid air conditioning/cooling;* - *maximize daylight;* - *sympathetic to surrounding buildings, etc.*	• Client requirements to be adequately defined. • Clear communication of vision, objectives, aspiration and client's requirements. • Enable innovation and cost effective solutions (Ministry of Finance 2004). • Clear, concise and comprehensive output specifications can delineate responsibility and minimize ambiguity. • Objective criteria should be used for performance monitoring. • Subjectivity should be kept to the minimum level. • A clear understanding of what is required and how it is to be monitored. • *Watch out for disputes* over interpretation and subjectivity. • Output specs should not be too prescriptive nor too brief.

• Affordability can create problems in the preparation of output specifications because the government has financial constraints and other financial commitments (Heavisides and Price, 2001). • The public sector may have to sacrifice some user requirements due to affordability constraints after entering into contract.	• Financial planning at the early stage of outline business case (OBC). • Striking a balance between the required services and available funding. • The public sector should not over-specify in excess of the limited budget.
• Unclear risk transfers if the public sector fails to transfer the risk to the private sector. • The public sector fails to quantify the operational risk including volume risk, availability, performance, maintenance, lifecycle, legislation and technology risks, etc.	• Clearly define exclusions of responsibilities. • Appropriate risk allocation to the party best able to manage them to achieve value-for-money objective. • Mutually acceptable risk allocation scheme should be adopted before the contract is awarded (Li et al, 2005). • Clear statement of third party revenue sharing.
• Using input based services specifications • Monitoring problems due to the mixing of input and output specifications (Edward et al. 2004).	• Avoid specifying input such as how to build facilities and how to design the work process but focus should be given to the output-based specifications, instead of input requirements. • Hybrid specifications may be used with care to avoid contradiction (Heavisides and Price, 2001).
• Miss-interpretations and different interpretations of contract documents.	• A clear understanding of what is required and how it is to be monitored, with clients confirming method statements submitted by contractors before contract signing.
• Change mechanism and re-negotiation problems. Change mechanism in the contract is considered as cumbersome and laborious (Partnerships UK, 2006). • Client's requirements may well change in response to shifts in technology, social expectations, and/or policy. • Changes in service requirements can lead to extra time and cost.	• Changes are inevitable and should be envisaged at the initial output specs drafting stage. • Foreseeable changes need to be addressed by pre-agreed framework to facilitate negotiation.
• Inflexible and rigid long term contracts.	• Flexible PPP contracts can allow variations in specification and requirements with appropriate an adjustment mechanism for payment to the private sector.
• Problems with performance measurement system (PMS). • Complex and a large number of key performance indicators (KPIs) and lack of clear understanding among the public and private sector staff (Robinson and Scott, 2009). • Too many and onerous KPIs are not easy to measure. • PMS is not rigorous enough. User satisfaction survey is not linked to the payment mechanism (Akintoye and Beck 2009).	• Clear performance standards and clear understanding of how performance will be measured and monitored. • A clear link should be made between payment mechanism with agreed standards and KPIs (Ministry of Finance 2004). • PMS should be *objectives, transparent*, *easy to measure* and *the same monitoring methods* should be used including customer surveys, performance and fault reporting system. • Establishing the right monitoring method against the required standard is very crucial for the public sector client and ensuring that justifiable deductions are made (Ministry of Finance 2004; Robinson and Scott 2009).
• Payment and performance mechanism may be complex and punitive and do not incentivize for over-performance (Partnerships UK 2006). • Payment mechanism does not incentivize the service provider to deliver higher services than stipulated in the contract. The service provider focuses to avoid performance	• Performance based payment mechanism is necessary to include incentive and deductions for failure of services. • Deductions should *reflect the severity of failure.* • Indexation, benchmarking and market testing are used to minimize the risk of inflation.

deductions rather than getting incentive for higher performance (Robinson and Scott, 2009).

- The assets may not be handed over to the public sector client in a good working condition and are not fit for its intended purpose after expiry of the contract.
- In the contract, the public agency should also specify the state of the assets at contract expiry and it should ensure that the assets are in reasonable working condition and fit for purpose at the end of the contract.

CONCLUSION

In order to achieve value for money, efficiency, innovative solution and risk transfer from the public to the private sector, clients' requirements can be written as service output specifications rather than as prescriptive specifications. A clear delineation of responsibilities is also an essential attribute of output specifications for ensuring appropriate risk allocation. Public sector clients need to devise effective performance monitoring tools. Output specifications should detail *what* needs to be achieved, not *how* it is to be achieved. Output specifications which lack clarity often cause disputes and can adversely affect the value-for-money of PPP/PFI contracts. It has been learnt that there are grey areas in the output specifications, performance measurement system and payment mechanism. There is a need to mitigate these deficiencies by writing outputs as objectively as possible and the public sector should not over-specify, keeping in mind the affordability constraints. PPP projects should deliver innovation, achieve value-for-money through whole lifecycle costing approach and maintain balance between affordability and user requirements. The public sector should ensure that the defined outputs are met by the service provider and also ensure that risk allocation, payment of the unitary charge, reporting and variations to the contract are effectively managed. Learning from previous projects can avoid future pitfalls in developing output-based specifications.

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PPPS FOR TRANSITIONAL ECONOMIES: SOUTH AFRICAN CASE STUDY

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ABSTRACT

Most countries in Africa have recognized that economic transition does not necessarily mean moving from a state-controlled to a liberalized economy. This is demonstrated by attempts to extricate themselves from economic climate dominated by patrimonial and/or patron-client relationships to a western inclined rules-based system. The compromised environment affects the efficiency and effectiveness of any procurement method in achieving socio-economic objectives.

The profound political change in South Africa within an already existent free-market economy has resulted in economic transition, as the formerly disenfranchised black people seek meaningful economic participation. Through the policy of Black Economic Empowerment (BEE), the new democratic government has tried to use procurement as a tool to effect change and PPPs in particular have been identified as being critical in achieving economic emancipation. This research tracks one of the longest running PPPs in South Africa to assess if there is any alignment with government's socio-economic interests.

This research has demonstrated a substantial goal alignment catalyzed by PPPs peculiarities of longevity and protracted tender processes among others. It is hoped lessons learned in this research will not only help in streamlining legislation for future projects, but could also be of immense benefit to other pre-transitional and transitional economies in Africa and elsewhere.

Keywords: Black Economic Empowerment (BEE), Public Private Partnerships (PPPs), Transitional Economy,

INTRODUCTION

The economic transition in developing countries has not always been the result of a change from a centrally-controlled to a free-market economy. Transition does happen in an already existent free-market economic activity, when change is triggered by momentous political incident, as was the case in South Africa (Cameron, 2003). The release from prison of the ANC leader Nelson Mandela in 1990 was not just a political milestone, but it had repercussions to the social and economic life of about 30 million non-white South Africans who were previously disenfranchised (ibid). Elsewhere in Africa although there are very poor countries which can be labelled pre-transition, some countries have been transitioning as they divorce themselves from

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previously socialist inspired policies and embrace free enterprise (Mckinsey Global Institute, 2010). The 'traditionally acknowledged' transition economies of the former Soviet Union, Central and Eastern Europe, China and Vietnam, were similar in that their planned economies had been dominated by large firms, producing few consumer goods. Although Small and Medium-sized enterprises (SMEs) are a large part of every market economy they were almost non-existent in these economies (McMillan & Woodruff, 2002). Multi-nationals who enter these diverse markets will find contextual differences that require different adaptations. This research explores the lessons garnered in South African Public Private Partnerships (PPPs) where Multinationals are usually leading members of consortia Joint Ventures (JVs), because of their expertise, specialization and experience. Of particular interest is to find if synergy could be found between divergent interests of SMEs promotion by the host country, and profit maximization by the Multi-National Companies (MNCs).

LITERATURE REVIEW

Pessoa (2006) defines a *Public Private Partnership* (PPP) as a sustained collaborative initiative between the public sector and the private sector to achieve a common objective while both players pursue their individual interests. The third "P" of a PPP assumes a joint alliance beyond a traditional contractual relationship. However, Pessoa (2006) contends that the reality of PPPs in developing countries is based more on "complementarity" and not on cooperation. This happens while PPPs are increasingly becoming popular institutional arrangement, as they are perceived to remedy a lack of dynamism in traditional public service delivery (Jamali, 2004). While it looks like PPPs can be an efficient form of enhancing well-being and of promoting growth, the truth about the impact of PPPs is somehow out there waiting to be discovered (Pessoa, 2006). It is for this reason that all stakeholders involved in PPPs in developing countries share an interest in knowing more about their effects (ibid.). The interest of this study is to see how PPPs affect SMEs in transition economies, taking the experience of South Africa in one of the longest PPP projects.

The Role of SMEs during Transition

The SMEs sector carries great hope and great burdens in the evolution of all transitional economies (McIntyre, 2001). Although the role of SMEs in generating employment and an atmosphere of social stability cannot be gainsaid, hopes that this sector by itself will have systems-dynamizing and transformational effects have not been realized (EBRD, 1995). Successful development and deployment of SMEs allow desirable changes to take place elsewhere in the system without affecting or threatening social peace. This is because SMEs are able to absorb resources and workers from large enterprise sector, creating a labour market when large enterprises are being re-orientated and re-organized, thus avoiding disturbing social peace (McIntyre, 2001).

In China the start-up firms drove China's reform momentum; they were arguably the single main source of China's growth. The other ex-communists economies had similar experiences, this despite the fact that reformers did not anticipate their emergence and influence (McMillan & Woodruff, 2002). The omission of SMEs in the theoretical understanding and practical functioning market economies is predicated on market automaticity assumptions – i.e. spontaneous processes can be counted on to create new, viable entities to fill the interstices between large organizations (Riskin, 2001). Overlooking SMEs is detrimental to a complete

scholastic discourse on transition because globalization compels MNCs to interact with local SMEs, either positively or with sour consequences. According to Buckley and Casson (2003) most international business scholars, would rather influence the boardroom than the office of the president, where broader political, social and economic issues are analysed, simply because business pays better. The over-emphasis on business has led to a situation where advice that could have been given to politicians is withheld resulting in the perpetuation of weak institutions in host governments, a situation that is sometimes unfairly advantageous to MNCS.

Weak institutions in host countries

In many transition economies reformers and advisors share an appreciation of speed and secrecy, since this could musk personal appropriation of public assets where self-dealing is rife, masqueraded as 'expert' recommendation (Wedel, 1998). Real markets function 'successfully' only when a fairly elaborate set of surrounding institutional, infrastructural and behavioural conditions are already in place and are internalised as a cultural norm. Although technocrats who are in favour of allowing time to build market infrastructure, are accused of opposing market reform, this approach avoids a simplistic view of capitalism as a self-organizing system of natural equilibrium (McIntyre, 2001). Where there is no adequate institutional preparation, there will be a long-term dysfunction of the new system in transition, as was the case in Russia (Kolodko, 1999). This is manifested in extortion of bribes by bureaucrats, a lack of market-supporting institutions like courts to enforce contracts and unobtainability of loans from banks (McMillan & Woodruff, 2002).

Besides weak institutions in host countries, they also lack created assets like infrastructure and human capital (Narula & Dunning, 2000). Many transition countries today continue to wrestle with persistently high unemployment rates even though the 'transition' path has been embarked on for over a decade (Aidis, 2005). Aidis (2005) posits that a strong SME sector could provide further employment opportunities and contribute to economic growth as well as the development of the competitive market system. However, private business in transition economies is confronted with a multitude of barriers; the most important are *formal barriers* such as high taxation and general regulatory environment (Hashi, 2001); *informal barriers* like weak regulation implementation, corruption and unfair competition from a large informal economy (Bartlett & Bukvic, 2001). This shows that although SMEs are important to transitional economies the general environment must be conducive for their growth and survival. These critical requirements are discussed next.

Critical Requirements of SMEs

Development Economics research demonstrates that the SME sector by itself will not create a successful economic growth, without supporting local-level institutions, a surrounding context of successful large enterprises and facilitative overall demand conditions (McIntyre & Dallago, 2003). SMEs do not normally thrive without a set of continuing links to larger entities and measures to assure them market access (McIntyre, 2001). SMEs need large enterprises as a source of inputs and market for their outputs, thus a synergistic relationship between the SME and the large enterprise sectors is critical to avoid a zero-sum environment where success of the small is secured at the detriment of the large (ibid.). SMEs during transition are also crucial as a source of innovation potential and job creation possibilities (Aidis, 2005). The

MNCs entering transition economies need SMEs as they have extensive knowledge about government relations, laws and customs, on the other hand SMEs attain managerial and technological expertise from MNCs (Steensma & Marjorie, 2000). In order for the host transition economy to benefit from the MNCs, knowledge transfer mechanisms have to be understood.

Knowledge Transfer Mechanisms for SMEs

The processes of learning from an MNC partner willing to share knowledge are different from learning from unrelated businesses (Meyer, 2004). The knowledge spillovers come on the basis of: demonstration effects and the movement of labour. Within MNCs, even rank and file staff acquires skills, attitudes and ideas on the job through exposure to modern organisation forms and international quality standards. Many entrepreneurs of local firms started their careers working for MNCs, where they learned vital skills (ibid.). When MNCs work with local SMEs, the *technology gap* hypothesis proposed by Gerschenkron (1962) which stipulates that spillovers are increasing with the difference in technology levels between domestic and foreign firms in the industry, could be applied. If a relationship is a joint venture, two partners share their resources in return for access to the partner's resources and this can lead to mutual learning, and thus extend linkages and knowledge transfers in the local business community (Meyer, 2004).

METHODOLOGY

The methodological approach adopted in this research was phenomenological. Since the study is essentially about human behaviour and experience, it could only be effectively interrogated by having direct access through the lived experiences of the Black owned SMEs in PPPs JVs using interviews to assess their experiences. A phenomenological approach was adopted because it is holistic, with a primary focus on human experience and sustained contact with people in their natural experience (Munhall, 2001). The phenomenological paradigm was selected in this research because its qualitative approach is holistic in orientation and it treats the phenomenon as a whole system as it searches for patterns that lie with the boundaries of the research environment. Its empathetic inclination attempts to understand phenomena holistically from the perspective of the participants (Cupchik, 2001).

Yin (1984) cites the main reasons for selecting a research method as firstly the type of question posed; embedded in this research are questions of *how* and *why,* thus militating the use of a case study. *How* in the sense of establishing the approach adopted by Multinationals and the government in implementing SMEs involvement in PPPs and also *why* they were targeted given the history of South Africa. Case studies are also useful when the researcher has minimal control over activities and when the main focus of the inquiry is on a contemporary phenomenon in the real-life every day context (ibid.). Interviews formed a critical part of this research and through them respondents related their lived experiences. It was not expected that their stories were going to be objective 'facts' but they were rather authentic accounts of subjective experiences. That is why as much as possible it was intended "to formulate questions and provide an atmosphere conducive to open and undistorted communication" (Gubrium & Holstein, 1997, p. 116). Open-ended interviews with consortium shareholders and contracts managers of Black owned SMEs sub-contracted to the main Facility Management (FM) company involved in the operations of the project

were conducted. Probes served only to give direction to the discussion but the interviewees freely articulated the *hows* and *whys* of their JV experiences.

DISCUSSION AND ANALYSIS

The case study used for this research is an 850-bed referral hospital in the province of Kwazulu Natal just outside Durban. The Inkosi Albert Luthuli Central Hospital (IALCH) is named after the first president of the African National Congress (ANC) and a first South African Nobel prize winner Albert Luthuli, and it is one of the most modern in the country, boasting the novelty of being the first hospital in Africa to go paperless. All patients' records and scans are captured and retrieved electronically. When it opened it was the first provincial PPP project in the country. Consequently there was a concerted provincial and national governments' effort to instigate practical Black owned SMEs (mostly start-ups) involvement at all levels as the intention was that the project would be an example of best practice. The project has three tiers; the first is the shareholder level where the Previously Disadvantaged Individual(PDI)/black project sponsor, a PDI women's group, Medical supplier, Facility Management (FM) and Information Technology companies are all shareholders in the Special Purpose Vehicle (SPV), christened IMPILO.

The second tier is operational where all the companies except the PDI women's group are sub-contracted to the main SPV company at the first tier. At the third tier twelve (12) sub-sub-contractors are all sub-contracted mostly to the FM company and they perform various FM tasks from security, cleaning, portering, catering, waste management to store and warehouse management. The PDI women's group comprises of two different companies which teamed up for this project and they do most of their tasks together. They formed JVs with a number of reputable established companies to perform six different activities but they are all ultimately answerable to the main FM operator. Highly specialized activities like medical waste management are outsourced to independent vendors who have periodic contracts with the FM operator. The discussion section in these project looks at how Black owned SMEs were involved in this project, the role they played and experience they gained. This discussion is intended to provide a practical example that can be scrutinized for possible adoption elsewhere in Africa and other transitional economies.

South Africa has a very well developed legal framework that guides the PPP implementation. Since PPPs by nature have a protracted procurement mechanism, this helps the government to scrutinize the consortia proposals to ensure that there is congruency with government's empowerment policy. Most importantly it is the requirement for the inclusion of black owned SMEs as sub-contractors whenever possible. Their inclusion is a contractual requirement that must be verified during adjudication, and this is done to screen out fronting. The financial trickle down to the PDIs is strictly monitored throughout the project. All the international players also have to demonstrate a workable skills transfer plan that is monitorable because of the milestone they would have committed themselves to.

Project Approach

The approach that was taken at IALCH was to ensure that all the unskilled labour is first sourced from the surrounding community to ensure that the locals are the first ones to benefit from the scheme. There was a bursary fund availed to local high

school matriculants enabling them to study for professions that are related to skills required at the hospital. The hospital gave them experiential training when this was required and there was no strict requirement to serve the hospital once they have completed their studies. The longevity of the project had other positive spin-offs; pre-school education of the staff's children had to be offered onsite, since there was no good school in the vicinity, as the surrounding Cato Manor area is an impoverished township designated for Indians and blacks under the apartheid system. This school is open to the members of the community, for those who can afford and it is providing a world-class foundational education that would not be easily accessible to the locals.

The PPP requirement of PDI SMEs involvement led to the formation of start-ups who wanted to be involved in this project. Although some of them were professionals, they had never been involved in business as this was the preserve of whites in the past. After working in the project most of them could see their businesses growing, and some had already started other initiatives outside the project. This is what one of the ladies had to say*: "But it is has been worth it. ... there is ownership there. You've learned employing people… paying them… how to deal with a workers' strike…. we've heard it all. I started a company with other professionals and we invested in a big pharmaceutical multinational company, which is a good investment."* The approach of the Facility Management (FM) Company was for them to share office space, and have a direct daily interaction. This has helped a great deal: " *you see us as service providers we are run by a head company FM operator which sub-contracts all the work to us and everything is being monitored every second of the day. So all service providers are keeping up to whatever service standards they need to keep up to."* Besides the *demonstration effect* from sharing space with the main contractor some of the managers were seconded to other sites of the FM Company to be mentored in different scenarios.

It is not only the management that was targeted but the rank and file staff benefitted by working in a world class facility. The FM Company went an extra mile for instance by ensuring that everybody who works in this facility is computer literate, from cleaners upwards. This skill is not only helpful here at the facility but it is going to be of benefit even when people leave the facility to work elsewhere. Since most of the people had not worked in a similar environment because the companies were mostly start-ups, the *technology gap* was big. The emphasis on the MNCs to have the ultimate performance responsibility, ensured proper training and mentoring of the SMEs, which was not only going to help the performance of the project but was a foundation for a whole new entrepreneurial opportunities.

Generalization of Findings

Although the transition economies are diverse all the lessons learned from elsewhere have to be contextualized, it is worth comparing lessons from South Africa with experiences articulated above in literature. Since start-ups were crucial in driving the economies of most countries, PPPs can provide an incubatory environment where these are nurtured under the government's watchful eye and given enough time to mature, since PPPs have a long duration. Without government intervention and assistance the success of SMEs is compromised, and with that the health of the economy. The emphasis by South Africa to include PDI SMEs has resulted in confident new business people that were suppressed previously by the very state

institutions. And this is instructive to other governments not to leave the economy to self-propel as this could result in exclusionary practices detrimental to the SMEs.

Although some transitional economies are not showing much by way of emerging from their transition, the weak institutions could take greater blame for not providing a conducive environment amenable to weak SMEs. The South African government took a lot of time studying the UK PPP model before adapting it to South Africa; this happened in a country that already had an advanced business culture. Whereas speed and secrecy has led to a lot of self-dealing and corruption in other jurisdictions; screening of proposals, for SMEs meaningful involvement in PPPs and protracted negotiations have mitigated fronting and malicious compliance in South Africa. In South Africa the special legislation: *codes of good practice for BEE involvement in PPPs specifically* deals with unique PPP environment in involving PDI SMEs in projects. This put the MNCs in a position where they know what the government goals are in involving SMEs in PPPs and this has mostly improved congruency and contractual relations. The requirement to form JVs with the local SMEs has served to improve the *demonstration effect* of the locals learning. Some members of the sub-contractors were already looking beyond the project where they can deploy the skills they had learned. The 'quantum leap' in skills attainment could not have been garnered within that time if they were not partnered with experienced MNCs. This confirms the importance of MNCs assistance in skilling the local SMEs especially where the *technology gap* is big.

CONLUSION

Although transition economies are diverse and unique, the South African experience can be emulated and adapted elsewhere. PPPs longevity is amenable to start-ups nurture, and start-up development is critical as they are drivers to any transition economy growth. *Demonstration effect* is very effective when entering *Greenfield* markets (undeveloped/un-entered) where experience is wanting, as the South African black community was. This militates towards the case of JVs which are a prerequisite in PPPs. Where there is a huge *technology gap*, comparatively JVs could be the most effective tool. This is instructive as the technology gap should not be a hindrance in involving local players.

State intervention is critical to SME success to mitigate exclusionary practices by MNCs, and PPPs provide a long-term incubatory environment for SMEs. Well articulated laws are very helpful during transition when PPPs are adopted, as project failure could lead to a lot of negative economic ramifications. Openness and transparency is critical for PPPs in luring MNCs who yield so much knowledge to SMEs in PPPs. The uniqueness of South Africa militates against the generalizability of this study but the lessons are instructive to most transitional economies.

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PUBLIC-PRIVATE PARTNERSHIPS: A LEGAL VEHICLE FOR ROAD CORRIDOR DEVELOPMENTS

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ABSTRACT

The development impacts of road corridors are important and substantially greater than the cost of the actual road construction. Resultant property and socio-economic development is widely discernible, but difficult to quantify. A suitable legal and economic vehicle is required for execution of projects making public-private partnerships (PPPs) attractive. The theoretical bases for these developments have been analysed and evaluated. The Maputo Development Corridor (MDC) stretching over 590 km from the economic heartland of South Africa to Maputo, the capital of Mozambique, was used as a case study. Extensive literature reviews covering the period since inception in 1996 to date were undertaken. Quantified studies were conducted and qualitative observations made. The study results indicate consensus that many development objectives are met, whilst others are difficult to quantify. Reliable statistical data on traffic movements, harbour usage, etc. are available, but the substantial "trickle-down" effect observed is difficult to quantify. PPPs are hailed as desired vehicles, if not a mandatory requirement to create sustainable infrastructure, such as road corridors.

Keywords: nodal points, property and socio-economic development, spatial development.

INTRODUCTION

The development impacts of road corridors are important and substantially greater than the cost of the actual road construction. Resultant property and socio-economic development is widely discernible, but difficult to quantify. A suitable legal and economic vehicle is required for execution of projects, making public-private partnerships (PPPs) attractive. PPPs are also known as P3s and in the United Kingdom mostly called PFIs (Private Finance Initiatives). The theoretical bases for these developments have been analysed and evaluated. The Maputo Development Corridor (MDC) stretching over 590 km from the economic heartland of South

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Africa to Maputo, the capital of Mozambique, was used as a case study. This road corridor is known and mapped as the N4 (National Highway 4), a toll road. Trans African Concessions (Pty) Ltd (TRAC) is the concessionaire that built and operates the MDC. Extensive literature reviews covering the period since inception in 1996 to date were undertaken. Quantified studies were conducted and qualitative observations made. The study results indicate consensus that many development objectives are met, whilst others are difficult to quantify. Reliable statistical data regarding traffic movements, harbour usage, etc. are available, but the substantial "trickle-down" effect observed is difficult to quantify. PPPs are hailed as desired vehicles, if not a mandatory requirement to create sustainable infrastructure, such as road corridors.

PROBLEM STATEMENT, OBJECTIVES AND DELIMITATIONS

The **problem** investigated is the following:
Do PPPs as legal vehicles have the ability to provide additional and suitable procurement avenues for fixed asset developments?

The **objectives** of the study cover the following:

- To conduct a survey of the typical structure of PPPs as legal vehicles for developments
- To describe the theoretical and planning and policy aspects underlying the development of corridors
- To utilise the MDC as a case study, reflecting the outcomes of an extensive PPP road corridor development. Empirical research was undertaken to establish perspectives of beneficiaries and other stakeholders

The following **delimitations** apply to the study:

- PPP fundamentals portraying perceived practice are provided, while a comprehensive practice guide is not provided.
- The MDC is used as case study to demonstrate outcomes, expanded where relevant, to reflect broader regional and African perspectives.

RESEARCH METHODOLOGY

The following research methodologies were applied:

Qualitative research methodologies

An internet survey was undertaken to establish the salient features of typical formats of PPPs. This has been reduced to descriptive research outcomes, thus a summary reflecting general practice.

Varying theoretical perspectives on regional planning as well as development corridors were compared and concepts related to corridors and their theoretical foundation revisited. Some sectors and components of socio-economic development have been included as well as main activities that have occurred since the inception of the MDC.

The changing South African government approaches to regional planning were also studied and qualitative, unstructured interviews conducted.

Quantitative research methodologies

Purposive sampling was applied and quantitative structured questionnaires were administered to business owners, -managers, government officials and professional people in the main centres, either on or very close to the corridor, during June 2011. In South Africa 76 questionnaires were completed and in Mozambique 14.

PUBLIC-PRIVATE PARTNERSHIPS AS LEGAL VEHICLES

PPP Constraints

PPPs are internationally used to create infrastructure. A number of countries have been identified by commentators over a several years as the "leaders" in the field. This report reflects some of these countries as well as some other first world countries that potentially have the skills and capacity to utilise PPPs. Many constraints hamper the development, application and benefits of PPPs to varying degrees, all over the world. The following are the most common constraints that contribute to the complexities inherent to PPPs, also contributing to the generally slow development of PPPs:

- Some concerns regarding privatisation have been transplanted to PPPs though the latter are not synonymous to privatisation, but an alternative procurement model that can be exploited in many ways.
- The most desired terrain for PPPs is in high-value projects, typically in $ billions, the magnitude of which overstimulates causative positions.
- PPPs are very long-term projects that do not only involve the provision of projects, but also "living" with them, often for generations. It is problematic for decision-makers, particularly civil servants, to commit the public for generations. The private sector in turn has to evaluate the road ahead, particularly financially, for unheard-of contractual terms and risks.
- Although not based on much quantified research, there is ample speculation that "private partners" are receiving unacceptably high returns from PPPs.
- The ability of governments to ensure PPPs' accountability is problematic in light of the complexities.
- PPPs are contractual arrangements, practiced legal vehicles to achieve the objective of meshing public sector physical facility needs, with the overall capacity, often including financial capacity, of the private sector. It should thus be possible to structure PPP agreements that ensure mutually beneficial outcomes.
- The above constraints seem to retard development, to the detriment of both the public and the private sectors. The lack of universal (or national) PPP procurement guidelines and model contracts/legal documentation increases risks and strains implementation.

International perspectives

The following perspectives regarding a number of countries shed light on the utilisation of PPPs:

Australia

Australia is presently hailed by many as the leading nation regarding PPPs. The following literature reflects the Australian position:

- The Australian Government (2008) overview: National Public Private Partnership Guidelines, reflects the following:

- Infrastructure is the main focus of PPPs with the private sector providing design, construction, financing, maintenance and delivery.
- Government contributes land, capital works, risk sharing, revenue diversion, purchasing of agreed services.
- The private sector receives payment from government or users of economic infrastructure (including toll roads: "user-pay") contingent on the private sector's performance.
- PPPs are not synonymous to privatisation.
- Table 1 shows the key difference in procurement methodology in Australia, portraying to a large extent the universal position.

Table 1: Comparison of traditional procurement and PPPs

Traditional procurement	PPPs
Government purchases an infrastructure asset	Government purchases infrastructure services
Short-term design and construction contracts (two to four years)	One long-term contract integrating design, build, finance and maintain
Input-based specifications	Output-based specifications
Government retains whole-of-life asset risk	Private sector retains whole-of-life asset risk
Payment profile has a spike at the start to pay for capital costs, with low ongoing costs	Payments begin once the asset is commissioned. The payment profile is relatively even, reflecting the level of service provision over the longer term of the contract
Government is usually liable for construction time and cost overruns	Private contractor is responsible for construction time and cost overruns
Government operates the facility	Government may or may not operate the facility
Government manages multiple contracts over the life of the facility	Government manages one contract over the life of the facility
Often no ongoing performance standards	Performance standards are in place. Payments may be abated if services are not delivered to contractual requirement
Handover quality less defined	End-of-term handover quality defined

- The key steps in investment and procurement decision-making are portrayed in Figure 1, also reflecting universal methodology.

Figure 1: Key steps in investment and procurement approval

- The Australian Government (2008) *National Public Private Partnerships Policy Framework* sets the following objectives:
  - Encourage private sector investment in public infrastructure.
  - Encourage innovation.
  - Ensure rigorous governance of the selection of PPP projects.
  - Provide a framework for streamlined procedures.
  - Clearly articulate accountability for outcomes.

- Infrastructure Partnerships Australia ([s.a.], online) reports the following key findings on PPPs and traditional procurement:

- PPPs are clearly superior in cost-effectiveness.
- PPPs are expected to contribute a 10-15% share of infrastructure during the next decade. This will generate $6 billion (Australian) in potential community benefits.
- PPPs are generally executed faster than traditional projects, being superior in terms of cost and time, improving with size and complexity.
- Contrary to popular belief, PPPs are more transparent than traditional projects.
- PPPs provide an additional procurement avenue that furthermore provides benefits far beyond the construction time of the projects.

Canada

PPP Canada was created as a Crown Corporation with an independent board of directors. Its mandate is to improve the delivery of public infrastructure by achieving better value, timelines and accountability to taxpayers through PPPs.

PPPs are utilised by federal government, also increasingly being viewed more favourably by provincial governments in Canada.

PPP Canada (2010-2011) reflects the following in their Annual Report on PPPs:

- PPPs are delivering a broad range of public infrastructure on-time, on-budget projects, reducing risk and maximising value over the entire project life cycle. This includes transportation.
- Integrated solutions regarding design, construction, finance and operation of public infrastructure are developed. PPPs draw leading expertise together in all aspects, using the discipline of competition and capital markets to ensure private sector delivery.
- Federal government is increasingly dedicated to promote the use of PPPs.
- Federal government has committed to the future assessment of the suitability of federal projects for PPP application. All projects with a capital cost in excess of $100 million (Canadian) will be required to be assessed for PPP suitability.

United States of America (USA)

PPPs in the USA are regarded as an evolving market with new opportunities according to Chase (2009), who regards PPPs as moving through three generations. PPPs have moved on from first generation monetisation deals, now in transition from the second generation ad hoc projects to the present third generation, where projects with potential should be selected and advanced to well-structured PPP programmes.

Private investors and public pension funds are very specific that they require infrastructure in their portfolios.

During the first generation, public officials for the first time considered innovative private financing. Some unsatisfactory results, however, discredited PPPs. The second generation also posed problems blamed on public sector fragmentation. However, success has been achieved with corridors and user-pay projects. Improved alignment of interests, incentives and risk sharing between public and private partners have produced better results. But, the lack of a comprehensive PPP programme still results in ad hoc projects in project partnerships, each time reinventing the wheel.

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Performance-based approaches have evolved in the third generation, now fostering the development of policy and detailed implementation processes through PPP units in government agencies.

Reinhardt (2011) recently reported the following status:

- Noteworthy PPP progress has been made in the water market with quality improvements due to PPPs.
- Buildings provide an opportunity to be exploited by gains that could be made on the misallocation of risks costs as high as 30% of project costs which may be saved by appropriate risk distribution.
- Highways have been developed on an on-off PPP basis but are not developing consistently. Yet, Canada, starting at the same time, has established numerous very successful PPPs, presently at the rate of $300 million (Canadian) annually.
- As yet there is not a financial formula for USA highways. There seems to be general consensus that the creation of an intelligent coast-to-coast highway system is only possible on a user-pay basis, thus tolls.
- Like Puerto Rico, it is time that government (USA) realise they are broke and cannot meet expectations. Like Puerto Rico, the USA government could discount this fact and utilise PPPs to tap into private sector capital, creativity and long-term diligence. Puerto Rico is very successful in this regard.

United Kingdom

The UK more often refers to a Private Finance Initiative (PFI) than to a PPP.

The PPP Forum (2011) describes a PFI as a procurement method where the private sector finances, builds and operates infrastructure and provides long-term facilities management through long-term concession agreements. The lifespan of these concessions is at least 25 years. Payment is only made if services are delivered according to the requirements of the concession.

The National Audit Office in 2003 estimated that 73% of procurement under traditional methods was delivered over budget and 70% was late.

PFI from both a public and a private perspective was challenged to address the above deficiencies.

PFI projects have now probably become the largest infrastructure sector in the UK. Over the past fifteen years the PPP Forum has reported over £60 billion worth of projects signed. This includes almost 100 hospital schemes, more than 100 education projects, more than 800 school projects, 43 transport projects and over 300 other operational projects.

Risk is distributed in PFI projects and the private sector accepts the risks that they can best manage. Construction and design rest with contractors; finance providers take the financial risk; etc. Typical PFI participants are construction contractors, insurance companies, banks, equity investors, professional advisors and obviously the public sector participants from transport, health, education, etc.

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It is estimated that PFI projects are about 2,25% more expensive than traditional projects, attributed to the cost of private sector finance, versus lower-cost public finances.

Europe
The European view of PPPs is overly positive, but politically challenged.

The major motives for moving towards PPPs in Europe are macroeconomic, budgetary and improving efficiency of public service delivery, as reported by McQuaid and Scherrer (2008).

In some European countries there is a strong preference for consensus societies. The political context in Europe is also different from that in Anglo-Saxon countries. There is a reluctance to increase the level of direct privatisation. This position is also confirmed by recent political developments in a strained Eurozone environment.

However, some regard PPPs as the middle ground, and not as privatisation. The uptake of PPPs in Europe is slow, but with the impact of high tax burdens and restrictions placed on governments to borrow money, PPPs are becoming attractive to raise private funds to close infrastructure gaps.

Overall there appears to be considerable scope to develop PPPs in Europe.

South Africa
- PPP Manual
  The Department of Finance (2004) has created a PPP Manual. In the preface the following statement is made by the minister of finance:

  > *National Treasury's PPP Manual* is indeed a world first. It systematically guides public and private parties through the phases of the regulated PPP project cycle for national and provincial government, unpacking policy and providing procedural clarity as it does so. It draws on South African project experience to date and on best international practice, without infringing on the authority of accounting officers and authorities. It sets rigorous risk-assessment standards by which government will make affordable project choices that best leverage private investment for quality public services.

  This manual contains sections on regulations; code of good practice; inspection; feasibility study; procurement; management of agreements; auditing; accounting; project finance.

  Although the PPP Manual is available, and some very successful projects, such as the MDC, had been undertaken even before the manual existed, the PPP procurement strategy has lost steam. There appears to be substantial private sector appetite to engage in PPPs, but the success rate of bringing PPPs to fruition is low. Private sector construction contractors have recently indicated that it is becoming too uncertain, cumbersome and costly to pursue proposals despite successful projects having been executed.

- The MDC

The MDC is a success story, also confirmed by the continued smooth operation of the legal format. The following are some of the noteworthy observations:

- The South African government's role included entering into agreements with the government of Mozambique and TRAC, which included facilitating the upgrading of an existing road to a well-managed and well-maintained road corridor of significant importance.
- The Build-Operate-Transfer (BOT) agreement provides for the N4 toll road to become the sole property of government after 30 years. Renewal is an option.
- The development equity was secured by a 20% contribution from the construction contractor consortium (including some international contractors) and 80% debt by four major banks.
- The road is so successful on a user-pay basis that it was refinanced in 2006 under improved terms and release of capital.
- Shareholders have been able to successfully trade their interests in TRAC. TRAC is thus a marketable investment instrument.

EXPERIENTIAL KNOWLEDGE GAINS: INTERNATIONAL LITERATURE REVIEW

The following experiential PPP knowledge gains are universal in character:

- PPPs do not imply privatisation.
- PPPs open additional procurement avenues.
- Key differences between PPPs and traditional procurement as indicated in Table 1 for Australia, are universal in character.
- Although they present "new" challenges, PPPs as legal vehicles have successful track records.
- There is a sufficient international knowledge base for the successful implementation of PPPs as legal vehicles for procurement.
- The pronounced use of private funds and expertise to create public infrastructure is hailed as an important accelerator of development.
- PPPs are particularly suitable for large and long-term (life cycle) projects.
- Introduction and utilisation of PPPs require concerted effort and dedication from all stakeholders.

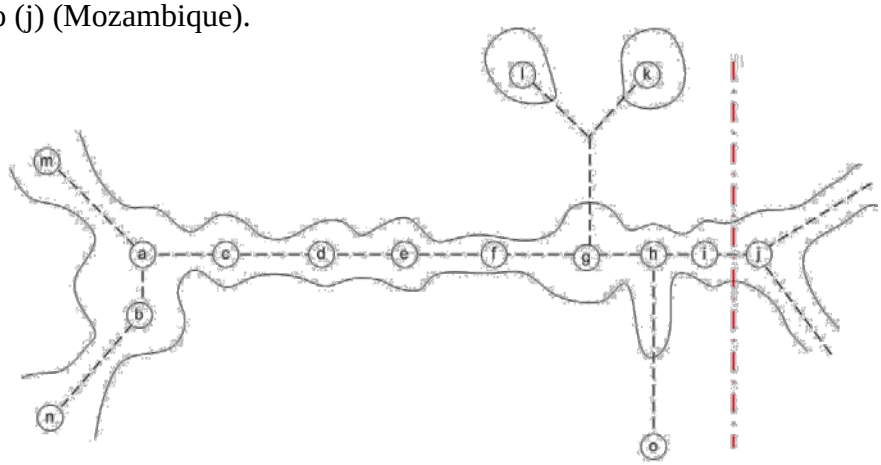
THE MAPUTO DEVELOPMENT CORRIDOR: A CASE STUDY

Theoretical aspects regarding regional and spatial planning

According to Gertler (1972), regional planning is directed towards facilitating development, private or public, in a manner that results in areas where people settle, establish regional communities and create the best environment and the soundest use of resources that civilisation is capable of effecting. Regional planning is viewed as a phenomenon which distributes economic resources centrally between regions in an effort to achieve certain regional and national objectives. Furthermore, regional planning is a necessary endeavour to address pressing economical, physical, social and environmental problems of regional significance (Glasson, 1978). Friedmann and Alonso (1964) define regional planning as a process which integrates development at a national level, and increases investment opportunities through strategic decision-making and planning endeavours at a regional level and economic development programmes at subnational level.

Glasson (1978) is of the opinion that growth occurs along diverse channels and is intensified at certain development poles with variable intensities. Perroux (cited in Glasson, 1978) propelled this theory and argues that intensified development should occur in certain growth points or economic spaces from which outward-working forces are generated and to which inward-working forces are attracted. Jooste (1994) postulates that the growth pole theory is one of the most renowned strategies to ignite development in underdeveloped regions, especially rural ones in a regionalised or nationalised planning system. He further argues that the main objective of regional planning theory is to encourage economic dispersal and to counteract the process of isolation and disintegration of marginalised areas. The rationale behind this theory is premised in the principle of agglomerations and transmissions of economic benefits through certain spheres of influences or poles. The theory highlights the importance of intensified economic development at certain locales with divergent benefits across certain spheres. Gauteng and Maputo can be seen as agglomerations of economic and industrial activities while the MDC may be seen as a channel (axis) to spread the economic and social benefits from and to these two growth poles.

Figure 2 diagrammatically reflects the present MDC, also indicating "development areas" into Swaziland, capital city Mbabane (o) to the east, and the northern regions of the Limpopo province with dual development nodal points at Polokwane (l) and Phalaborwa (k). Other corridors also project out of the terminal nodal points of the MDC at Pretoria (a) to (m)/Johannesburg (b) to (n) (Gauteng, South Africa) and Maputo (j) (Mozambique).



a:	Pretoria	f:	Machadodorp	k:	Phalaborwa
b:	Johannesburg	g:	Nelspruit	l:	Polokwane
c:	Bronkhorstspruit	h:	Malalane	m:	Rustenburg
d:	Witbank	i:	Komatiepoort	n:	Vaal Triangle
e:	Middelburg	j:	Maputo	o:	Mbabane

Axis: — — — — — — — — —
Border: — · — · — · — · — · — · —

Figure 2: Diagrammatic presentation of MDC with development arms

The Japan International Cooperation Agency (JICA) (2010:1-276) has prepared a comprehensive study titled *Preparatory Survey for Southern Africa Integrated Regional Transport Programme*. This study was conducted to cover the region reportedly with the highest cross-border traffic in Africa, covering the eight most

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southern countries. Figure 3 indicates the existing 18 corridors, for which in each case comprehensive trade movement data is available. Some of the corridor positions are (probably) not geographically 100% correct, but the overall presentation is acceptable for the purpose of this paper. From a socio-economic perspective, comprehensive data is available for each of the countries regarding demographics, scale of economic activity, governance and the business environment. From this, a corridor development priority programme has been created for southern Africa.

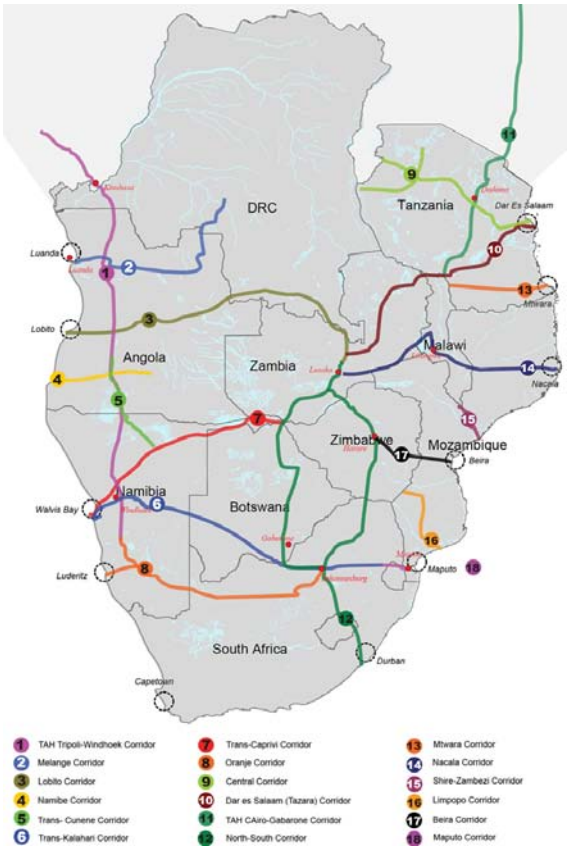

Figure 3: Southern Africa Transport Corridors and Major Ports (JICA, 2010: 2-22)

Government initiatives: PPP as vehicle

The objective of the National Physical Development Plan (South Africa, 1975) was to link existing metropolitan areas with identified or future growth poles by means of development corridors. Geyer (1986) found that some corridors were not supported by secondary development centres (nodal points) on one of the terminal ends of the axis, or were stretching over too long distances to be influential in making development realistically viable. The greater the distances between centres, the stronger these centres should be as development centres. In some cases so-called corridors are not corridors but only finger developments with no equilibrant development centre at the other end.

The Spatial Development Initiatives (SDIs) of the South African Government, conceived in 1995 by the Cabinet was an attempt to improve investment in those areas where the greatest potential for growth exists (Jourdan, 1998). The MDC satisfies economic realities, Maputo being the closest harbour to Gauteng. In the 1970s 40% of the export from Gauteng went through this port, but this faded away due to socio-

political factors (Jourdan, 1998). However, strong growth has subsequently been experienced, following new political dispensations, also manifested by the MDC.

The South African government's more recent National Spatial Development Perspectives (NSDP) of March 2006 provides a framework within which to discuss the future development of the national space economy. The NSPD reflects localities of severe deprivation and need; of resource potential; of infrastructure endowment; and of current and potential economic activity by describing the key social, economic and natural resource trends and issues shaping the national geography.

The MDC is regarded as a most successful PPP, with the concessionary already investigating further similar developments in Africa. In contrast to the success of the MDC (and several other similar corridors in South Africa) as a PPP project, the government agency, South African National Roads Agency Ltd (SANRAL) has recently completed a Gauteng toll-road system (that links the MDC with Johannesburg and Eastern Gauteng) with disastrous financial consequences. Allegations regarding exorbitant tolls and corruption have led to a supreme court ruling suspending tolls in April 2012, the outcome of a public outcry, legal action and possible payment boycotts. In stark contrast, numerous PPP projects are running smoothly, being managed by private sector concessionaries.

A "mid-term" overview

Söderbaum and Taylor (2003:6) compiled, with the aid of seven co-writers, a book, *Regionalism and Uneven Development in Southern Africa*, providing an in-depth analysis of the topic, focusing primarily on the MDC. The perspective they hold provides an important balance sheet, reflecting, albeit negatively, on the impact of the MDC. The following abstract, in some instances reworded and/or summarised for this report, is relevant:

The MDC is based on four key objectives:

1. To rehabilitate the primary infrastructure network along the corridor, notably road, rail, port and dredging, and border posts, with the participation of the private sector in order to have minimum impact on the fiscus.
2. To maximise investment in both the inherent potential of the corridor area and in the added opportunities which infrastructure rehabilitation will create, including the provision of access to global capital and facilitation of regional economic integration
3. To maximise social development, employment opportunities and increase the participation of historically disadvantaged communities
4. To ensure sustainability by developing policy, strategies and frameworks that ensure a holistic, participatory and environmentally sustainable approach to development

Concluding remarks by Söderbaum and Taylor (2003) suggest, contrary to popular belief, that the MDC is a failure as the stated objectives 3 and 4 have not been achieved. They fail to acknowledge or fundamentally evaluate the real effect of the "trickle-down" impact or to provide guidance as to how objectives 3 and 4 should be practically brought to fruition. Guidance is also not provided as to how the desired social development and employment resulting from the MDC are measured, or are measurable. The positive outcomes regarding key objectives 1 and 2 are evaluated by

Söderbaum and Taylor (2003) as negative, probably because 3 and 4 are emphasised as failures. These views are fundamentally flawed and contradictory in view of the obvious positive outcomes of the MDC project.

African continent
Jourdan (2008:20) reports:

> An African Development Corridor desk-top study was undertaken by the RSDIP(Regional SDI Programme of the SA Department of Trade & Industry) & Mintek (for NEPAD) in 2006 to investigate the potential and status of continent-wide development corridors, examined in a preliminary fashion the potential of DCs across Africa. It makes the case that Africa's physical and social infrastructure needs are so large that they cannot be met in any reasonable time frame without substantive contributions from the private sector.

The Japan International Cooperation Agency (JICA) (2010:1-276) study confirms substantial growth in Direct Foreign Investment (DFI) in the region since 2005. However, to ensure sustained development, corridors are a key requirement for growth. JICA (2010:ES-4) states:

> The existing 18 corridors in the region connect local mineral and agricultural resources with global markets. The study proposed re-defining the role of regional economic and transport corridors according to growth scenarios (strategies), building on the growth belt concept, which encompasses the integration of resources, value creation, and global markets.

A World Bank (Africa Region) Summary Report (2010:4-21) regarding Mozambique, states that the further extension of the MDC is anchored in a "growth poles strategy" that supports the position in this report, i.e. that development centres/nodal points/growth poles are key drivers of corridor development. Evidence indicates that "a road is a road" that connects poles, and development tends to take place mostly in the centres/nodes/poles, with the axis benefitting socio-economic development, along the corridor in a catalytic fashion.

Noteworthy in this summary is the lack of specific "social upliftment" strategies, silently supporting the view that private economic development is the driver of development in general. "Social engineering" is not mooted and it could therefore be assumed that "social development" is regarded as an automatic "trickle-down" beneficiary of private sector-led economic growth initiatives.

Observations 2010
An interview with Chief Executive Officer, Brenda Horne (2010) of the Maputo Corridor Logistics Initiative (MCLI) was conducted to obtain a perspective on the ensuing years since 2003, thus observing the resultant outcomes up to 2010. The MCLI, a non-profit company, was registered to create a body where all stakeholders may contribute to develop the MDC in their collective best interest. The MCLI subscribes to the following mission: "To support the development of the Maputo Corridor into a sustainable, highly efficient transportation route, creating an increasingly favourable climate for investment and new opportunities for communities along the length and breadth of the Corridor".

In pursuance of the above, the following provides an overview of the MDC as perceived by the MCLI presently, as was published as an MCLI Editorial in *Export News*, February 2009:

- To date, the private sector has committed an estimated figure of well beyond US$5 billion worth of investments in southern Mozambique and Mpumalanga.
- Some US$70 million has been invested in the priority works programme at the Port of Maputo since April 2003, including dredging and marine operations, cargo handling, terminal and warehousing functions as well as port planning and development. Before the end of 2004, the port had been working 24/7 in full compliance with the highest international security standards, the first African port that is International Ship and Port Facility Security compliant.
- Trans Africa Concessions (TRAC), a founding member of MCLI, has spent US$400 million on the rehabilitation and upgrading of the road from Gauteng to Maputo, with at least another US$400 million to be spent on the road over the balance of the 30-year concession. The fact that this road has drastically reduced travelling time between the two countries has contributed significantly to the increase of traffic and consequently trade. TRAC has indicated that traffic volumes have increased by between 5% and 7% per annum, with truck traffic increasing by 10% per annum.
- By 2007, passenger transport between South Africa and Mozambique had increased by 80% since the lifting of visa requirements between the two countries in April 2005. This phenomenal increase has put pressure on the existing infrastructure at the Lebombo/Ressano Garcia border post, which is being addressed in the planning and implementation of a joint 24-hour one-stop border post scheduled for completion during 2010.

Questionnaire results: Stakeholders 2011

Out of the 76 respondents in South Africa that completed questionnaires and 14 in Mozambique (the relatively low number of respondents in Mozambique could be attributed to most of the people approached not being fluent enough in English to complete the questionnaires and only 89 km of the corridor being in Mozambique) the minority of the South African respondents, 10,5%, had over 20 years' experience in their current field of work while the majority, 40,8%, had fewer than five years' experience. In contrast, the majority of the respondents in Mozambique, 42,9%, had over 20 years' experience in their current field of work while only 7,1% had fewer than five years' experience.

If the substantial "Neutral" and "Missing" responses from Table 2 are ignored (taken as 0), the "disagree" and "agree" categories provide an enhanced and more powerful response, reflected in the columns marked with an *. The figures provided are expressed as percentages based on the data which reflect an opinion.

Table 2 below shows some of the perceptions of the stakeholder respondents regarding the impact of the MDC on general economic growth. The data obtained has been drastically simplified for this report.

Table 2: Simplified MDC stakeholder perspectives

Q1: General economic growth is attributable to the MDC (Result: Agree)
Q2: Business improved due to incentives by government (Result: Disagree)
Q3: Business improved due to revitalisation of Maputo harbour (Result: Disagree)
Q4: The MDC contributes towards wealth creation (Result: Agree)
Q5: The MDC contributes towards job creation in the region (Result: Agree)
Q6: The MDC caused infrastructure development (water, electricity, roads, etc.) in the manufacturing sector (Result: Agree)

Question No.	South Africa					Mozambique				
	Disagree-ment	Agreement	Neutral & missing	*OMIT Neutral and missing		Disagree-ment	Agreement	Neutral & missing	*OMIT Neutral and missing	
				Dis-agree-ment	Agree-ment				Dis-agree-ment	Agree-ment
Q1	24	38	38	39	61	7	64	29	20	80
Q2	54	29	17	76	24	36	37	27	55	45
Q3	43	32	25	63	37	43	14	43	50	50
Q4	26	33	41	39	61	7	64	29	20	80
Q5	30	34	36	36	54	14	50	14	29	71
Q6	30	41	29	51	49	21	43	36	37	63

CONCLUSIONS

The presented data on the MDC, particularly the N4 toll road, overall reflects a highly successful outcome. As a PPP it passed the success test in most respects. The main critique is related to socio-economic issues. However, there is neither acceptable evidence that this criticism is justified, nor is it quantified. Benefits stemming from the MDC as a PPP project are overwhelmingly discernible as “trickle-down” results, but difficult to isolate and quantify.

From the qualitative data it could be concluded that the success of corridors as transport routes and, importantly, creators of general socio-economic development, is undisputed. It could be stated that without the successful development, maintenance, border-crossing improvement and optimal functioning of ports, socio-economic development and regional trade growth and integration will be seriously compromised for the entire region. A noteworthy shortcoming in general is the lack of quantification of benefits per capita to support qualitative observations. Quantitative data collection per questionnaire, in the mode of a survey for this study, also presents collective perspectives.

It is also difficult to specifically adjudicate positive developments that emanate from the MDC into detailed socio-economic segments. Local municipalities, especially those on the N4 road along the MDC corridor, see the MDC as an important component in planning and marketing. The positive effects of the corridor are clearly there, and in some instances measurable, but very difficult to quantify according to specific growth in specific sectors. It is rather in the style of a mass movement than individual events. Collectively the data supporting growth resulting from the MDC is undisputed physical development that observable, particularly pronounced around development nodes on the axes, and at terminal development nodes. The terminal development nodes in particular, and some secondary development nodes, show strong support for the development of further corridors. It is clear that regional socio-

economic development, particularly in Africa, will benefit extensively from corridor developments. It is also concluded that the "trickle-down" effect of development corridors calls for further research, with particular focus on quantification of its effect on the different economic sectors.

The overall evidence portrays PPPs as attractive vehicles for the development of road corridors. It adds expertise and financial resources to the creation of road corridors. Regarding Africa, and many other places in the world, PPPs offer a structured legal solution for the enhancement of road (and many other kinds of infrastructure) development. Local and regional needs can benefit from "internationalised" PPP solutions.

Well-structured and -managed PPPs provide satisfactory financial outcomes, expressed as return on investment. Public and private partners should strike a balance between development imperatives and return on investment, in a transparent fashion. Government agencies, like SANRAL, not being primarily driven by "business" motives like a private partner, are seldom adequately equipped with the necessary combination of business and technical skills to bring difficult solutions to the fore at an acceptable risk level.

No evidence was found which indicated that any of the countries described have adequate financial and other resources to responsibly further circumvent the necessity and potential of PPPs for infrastructure development, particularly roads/corridors that offer simple user-pay options.

The following aspects require specific attention to engage PPPs successfully as legal vehicles for the creation of infrastructure:

- Policy and procedure guidelines are to be in place, providing optimal strategies regarding design, build, maintain, manage, finance, skills development, duration and close-out.
- The long-term risk elements could be demised by introducing reviews at certain time milestones, say 25 years.
- Transparency, accountability and reporting, similar to what is expected of public, listed companies, will counter suspicion of profiteering, corruption and other subjectively perceived risks.
- The identified "tradability" of equity and finance indicates the distinct possibility that PPP finance has the potential to become a typical private sector investment instrument.
- PPPs are not a panacea for all problems, but should be regarded as a very viable alternative for many projects that would normally under traditional procurement processes be executed less successfully or perhaps not at all.
- PPPs are complicated, but there is a wealth of successful PPP projects in the world from which lessons could be learned. It is not necessary to reinvent the wheel.
- Various legal frameworks have been tried and tested for PPPs. It is proven common cause to set achievable, satisfactory legal arrangements and risk mitigation.
- The most important missing link is the will and dedication to remove impediments and create policies, structures, procedures and model contract documentation for repetitive application.

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CAUSES OF VARIATIONS IN THE COST PER UNIT AREA IN UGANDA

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ABSTRACT:

The use of different depreciation methods, rates and the lack of centralized data source of costs estimates available to the valuers is the chief cause of differing costs per unit area in Uganda which leaves much uncovered ground for research. The findings reveal that variations in the costs per unit area were due to various factors such as; the differences in cost of information sources where several valuers used a single source of information while others used a combination of sources, which also varied from one valuer to another. Another cause of variation was the difference in the percentages that were attached to depreciation and which percentages were also an individual opinion while to others the percentage was established according to the age of the property. The assumptions were also different and some of the assumptions were also extremely exaggerated. Therefore valuers should agree on a standard method of assessing depreciation. Valuers should also agree on the most appropriate source of cost information or get a central source of construction cost information that is available to all valuers in order to reduce on the variations in the final estimated market value when using the Replacement cost method of valuation.

Keywords: Construction Cost, Replacement Cost Method, Valuation, Variations, Depreciation

INTRODUCTION

When carrying out a valuation of a property to ascertain its market value[2], it is ideal to use the Market Approach where direct sales comparisons are used to get the market values of the property being valued. However, in Uganda (Kampala) there is insufficient or at times total absence of data on recent sales and thus lack of comparable, hence most valuers' resort to using the Replacement Cost Method of Valuation. Replacement Cost Method of Valuation also usually referred to as the Cost method/Summation method refers to a method of ascertaining the market value

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of a property by reference to two key elements; the cost of construction and depreciation (Dr. Geho, 2002). The method is mostly based on the principles of Reproduction cost and Replacement cost. The Cost Method is a method based on the principle of substitution. The principle states that no rational person will pay more for an existing house than the amount for which he could obtain, by purchase of site and construction, without undue delay, a house of equal desirability and utility (Dr. Geho, 2002). The methods of estimating building cost when using the cost method include; the quantity surveying approach, unit-in-place cost, unit comparisons and the cost indexing method. Though valuers may have a standard method of estimating the building cost when using DRC, they usually end up with differing costs per unit area for similar buildings, which leads to very wide variations in the final market value that estimate for the same property.

LITERATURE REVIEW

Kampala has a young property market and thus attracts investors but information about recent sales of properties is unavailable due to a number of reasons. Due to this unavailable information and insufficient data about recent sales of properties, the Replacement Cost Method of Valuation is resorted to by most valuation firms in Kampala when carrying out the valuation mostly of residential properties. Though the method is widely used, valuers tend to return quite varying value estimates on the same piece of property. Variances in values are expected but the ranges evidenced are far too wide and varying. This may be due to fact that there is no exact science on the accepted variance or any literature written on the accepted ranges. Land comparisons are also not readily available when establishing the value of land on which the property is situated. International valuation standards state that; where there is sufficient market data to support the valuation, **Market Value** is derived. In other circumstances, where there is insufficient market data, the result will be **Non-Market Value** (IVSC, 2005). The replacement cost method is used in circumstances where there is insufficient market data, when use of the sales comparison or income capitalization method is not possible, and so the output will be a non-market value. However, when valuing specialized property where possible, the valuer develops land value, cost, and accumulated depreciation estimates from market information (IVSC, 2005: General Valuation Concepts and Principles, paragraph 8.2). In the cost approach, comparable data refer to the cost of building or development, and adjustments are made to account for differences in quantities, qualities, and utility. In addition, analysis of comparable land data and comparable depreciation estimates is undertaken (IVSC, 2005, International Valuation Guidance Note 1, paragraph 5.20.3). The cost method is mainly used on residential properties in Uganda and especially in Kampala city. This is because there is usually insufficient market data on such properties and thus lack of comparisons and hence the valuers cannot use the sales comparison method of valuation neither can they use the income capitalization method.

Conditions That May Lead To Variations In Costs Method Of Valuation

The method implies that there is equivalence between depreciated replacement cost and the market value under conditions of perfect competition, however, in real life there is no perfect competition and imperfections of the property market can result in market value being above or below depreciated replacement cost. Also the amount required to construct a building or a specific property price in the market does not represent the property's market value because some factors such as; special time

transaction considerations, such as a special relationship between the buyer and the seller, besides the transaction may have been part of a larger set of transactions in which the parties had engaged. Another possibility is that a special buyer may have been willing to pay a premium over and above the market value; the price paid does not present the true market value of the property. Also in estimating the cost of new buildings, discrepancies can result due to differences in construction quality that may be assumed by different valuers. Also at times the historical cost method is used but it is usually difficult to determine all historical development costs, in some circumstances, assets and liabilities may be shown at their historical cost, as if there had been no change in value since the date of acquisition. The balance sheet value of the item may therefore differ from the "true" value. Historical cost does not generally reflect current market value. When using the DRC, costs are usually derived from recent construction costs of similar buildings. But there may be marked variations in construction costs by buildings contractors for the same building this leads to variations in the costs per unit area. On the other hand, building costs may be derived from the construction market rather than the real estate market (Whipple, 1995). Different market forces therefore influence them even before depreciation is estimated. Depreciation assessments are largely influenced by personal feelings and there is no common agreement on the methods of refining the depreciation allowance. This usually leads to variations in the final DRC assessed. It is difficult to imagine a market in depreciation adjustments that is capable of being monitored and from which reliable adjustment factors can be derived. The US Appraisal Institute (2001) argues that: “the cost approach can be applied to older buildings given adequate data to measure depreciation” but “the difficulty of estimating depreciation in older properties may diminish the reliability of the cost approach in that context”. Certainly no research explains the nature of this market in depreciation or how it should be analysed to determine market-based depreciation adjustments. The cost approach is a direct consideration of the economic benefits and the period over which they might be enjoyed is not accurately captured in the value. A patented product may have been inexpensive to create but still have significant value because of the huge demand for product regardless of the selling price. Therefore, cost approach fails on the ground that economic benefits will be enjoyed are not directly considered to have significant affect on value

RESEARCH OBJECTIVES

1) Establishing reasons for the different values when using the Replacement Cost Method of Valuation and try to come up with ways to lessen the variance.

2) The study being the first of its kind hopes to set a ground work for a further in-depth study in the use of the DRC method of Valuation in Uganda

3) The research was mainly focused on variations in costs per unit area and not on the whole replacement cost method of valuation. The research was also focused on the case study, that is, valuation firms in Kampala city.

HYPOTHESIS

The use of different depreciation methods, rates and the lack of a centralized data source of cost estimates available to the valuers is the cause of the differing Costs per unit area in Kampala City.

MODEL

The use of different depreciation methods, rates and the lack of a centralized data source of cost estimates available to the valuers is the cause of the differing costs per unit area in Kampala City. International valuation standards state that; where there is sufficient market data to support the valuation, Market Value is derived. In other circumstances, where there is insufficient market data, the result will be Non-Market Value (IVSC, 2005). The replacement cost method is used in circumstances where there is insufficient market data, when use of the sales comparison or income capitalization method is not possible, and so the output will be a non-market value. However, when valuing specialized property where possible, the valuer develops land value, cost, and accumulated depreciation estimates from market information (IVSC, 2005: General Valuation Concepts and Principles, paragraph 8.2). In the cost approach, comparable data refer to the cost of building or development, and adjustments are made to account for differences in quantities, qualities, and utility. In addition, analysis of comparable land data and comparable depreciation estimates is undertaken (IVSC, 2005, International Valuation Guidance Note 1, paragraph 5.20.3). The cost method is mainly used on residential properties in Uganda and especially in Kampala city. This is as a result of insufficient market data on these properties and thus lack of comparisons and thus in this case the valuers can nevertheless use the sales comparison method of valuation nor the income capitalization method.

METHODOLOGY

The major elements that were executed in approaching the study consisted of planning, distributing questionnaires and scheduling of interviews. Planning included; a reconnaissance to map out the study areas while scheduling included organizing meetings with respondents and key informants. It was carried out using qualitative designs and quantitative designs. Qualitative designs were divided into descriptive, explanatory and evaluation designs. Interviews and questionnaires were utilized during the process of obtaining the opinions of key informants.

DATA SOURCES

The research was basically a case study of valuation firms in Kampala city. A deliberate simple random sampling procedure was also employed to (7) private real estate consultancy firms out of the (32) registered valuers with (25) valuation firms (ISU; 2008) whereby (3) valuers from each firm were interviewed and given a questionnaire to fill. The sample size was 21 valuers from 7 valuation firms out of 25 registered ones. 3 were chosen randomly to make 21 respondents. The primary data was collected from the case study using research instrument, that is, structured questionnaires. Twenty-one valuers from private firms were also interviewed on top of filing in the questionnaires to get the required information. Respondents were professional valuers from either government or private firms. Secondary data was obtained from of various valuation firms such as Allied Property Surveyors, East African Valuers and Surveyors, Associated Surveyors among others.

DATA ANALYSIS

Data Analysis, Quantitative data involved checking all field data to see whether they contained the required information, the results of the study was presented with the use of tables and charts to produce trends of the respondents. Techniques such as statistical description and tabulation were used for easy interpretation of the

quantitative data within the context of the study. Casual comparative educational search, which were part of the study, helped in attempting to identify a causative relationship between independent and dependant variables.

RESULTS AND DISCUSSIONS

The study covers responses from 21 respondents from 7 valuation firms in Kampala City out of 25 valuation firms. From each valuation firm 3 Valuers were selected randomly to answer the researcher's questionnaire.

Analysis of the valuers estimated market value for the property, which was under valuation.

As shown in the table below valuers came up with different market values due to several factors. The main difference was in the rates attached per unit area and this variation was because of the depreciation percentage used, the sources of cost information and the different assumptions. For the same property the valuers came up with the following market values.

Table1: Showing the estimated market values among different valuers.

Ranges Market values in shillings	No. of valuers	Percentage
120,000,000-140,000,000	6	29%
140,000,000-160,000,000	12	57%
160,000,000-180,000,000	3	14%

Source; Author's construct basing on the Field Work, April 2012

Analysis of the approaches used to come up with the cost in the Replacement Cost Method of Valuation.

From the survey carried out, it was realized that the Cost per Square Meter is most used in the Replacement Cost method of valuation as 21 out of 21 respondents responded to this approach as compared to the other approaches as shown below in the following table.

Table 2: Showing the most used approach in the Cost Method of Valuation

Approach	**Number of Responses**	**Percentage**
Quantity Surveying	None	0%
Unit-In-Place	None	0%
Cost Per Square Meter	21	100%
Cost Indexing	None	0%
Others	None	0%

Source; Author's construct basing on the Field Work, April 2012

Analysis of the use of Depreciation Factor in the Replacement Cost of Valuation

As shown in the table 3, all the respondents answered yes to the use of a certain percentage of depreciation in the method. This percentage is deducted from the final cost of the property before getting the final value. From the responses, it is evident that depreciation is an important factor when determining the market value in the Replacement Cost method of valuation. But the depreciation percentage varied from one valuer to another as shown in table 4 whereby 85% of the valuers used between 0%-20% depreciation percentage while 15% used between 20%-40% depreciation percentage and this was due to a number of factors such as; age of the property where by certain was attached per year, nature of the materials used, the purpose to which the property is put among other factors. Because of this, there was a variation in the rates used in costs per M^2.

Table 3: Showing the responses to the use of depreciation in the Method

Response	No. Of Respondents	Percentage
Yes	21	100%
No	None	0%

Source; Author's construct basing on the Field Work, April 2012

Table 4: Showing the depreciation percentage used on the same Property

Depreciation percentages	No. of Valuers	Percentage
0%-20%	18	85%
20%-40%	3	15%

Source; Author's construct basing on the Field Work, April 2012

Analysis of the information cost sources as used in the Replacement Cost of Valuation.

From the survey carried out on sources of cost information that are used in the Replacement Cost Method of valuation, It was realized that most valuers get their cost information from Quantity Surveyors, followed by Engineering firms/ Contractors, Architects, Real Estate developers. It was also found out that some valuers use a combination of the above sources such as Real Estate Developers and Contractors or Architects and Quantity Surveyors.

Table 5: Source of cost information used in the Replacement Cost of Valuation

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Sources of cost Information	No. Of Respondents	Percentage
Quantity surveyors	15	72%
Engineering Firms/Contractors	4	14%
Real Estate Developers	2	10%
Others	1	4%

Source; Author's construct basing on Fieldwork, April 2012

Analysis of factors assumed during the computation of the Market value using the Replacement Cost Method of Valuation.

From the responses of the sampled out population, some factors were considered and some assumptions made before the computation of the market value when using the replacement cost method of valuation and they included the following; The materials used on the property under the valuation, the functional and economic obsolescence on the property, the age of the property, purpose of valuation, site works (the percentage varied from one valuer to another), the location of the property, the accommodation, the interest of the property, services available such as electricity and water mains, reduced area of say the garage or the covered veranda depreciation per year, highest and best use, prices of the building materials were from a common market.

CONCLUSIONS

From the above research findings, it is evident that the variations in the Cost per M^2 in the Replacement Cost Method of Valuation is due to a number of factors which range from the sources of cost information, the assumptions used in the valuation, the depreciation percentage attached, to the factors considered during the valuations. The above facts do vary from one valuer to another and this leads to a big difference in the rates that the valuers attach per M^2 and thus a huge variation in the end market value of the property that is under valuation. Variations in the estimation of the market value are expected since they are valuer opinions and are due to different factors considered nonetheless when using the replacement cost method of valuation; the estimated market values between different valuers are extensive. This is due to the variations in the costs per unit area because of; the cost information differences where a single and combinations of information sources were used. Depreciation and property age percentage differences with individual opinion and percentages were attached.

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PRIVATE RETIREMENT VILLAGES: ANALYSIS OF RESIDENTS' NEEDS REGARDING SUSTAINABILITY AND WELLNESS

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ABSTRACT

Private retirement villages (residents purchase residences and are personally liable for all expenses, not subsidised) have been in existence in South Africa for about three decades. There are successful as well as failed developments. The main problems are the lack of well-defined requirements regarding residents' preferences, sustainability and creation of wellness environments. These problems have been addressed in this research in order to add value to the decision-making process for both property developers and potential buyers (residents). A literature review was undertaken, but literature in this field is limited, and some new envisaged elements which might be of vital importance, have not been agreed upon or tried and tested. Extensive primary data was collected in a structured fashion. The research is ongoing and presently being extended. The study has revealed specific development and resident indicators based on resident decision criteria. Preliminary observations indicate that problems experienced are comparable to first world experiences. A noteworthy international USA research organisation states: "With one of the highest Gini co-efficients of inequality in the world, South Africa is in a certain sense a micro-cosmos in which aging can be studied – the aging world in one country".

Keywords: development directives, measurable preferences, residents' requirements.

INTRODUCTION, PROBLEM STATEMENT AND METHODOLOGY

Private retirement villages (residents purchase residence and are personally liable for all expenses, not subsidised) have been in existence in South Africa for about three decades. During this period, certain laws have been introduced and the format and ways of delivering retirement villages to the market have developed. As was to be expected there were successful as well as failed developments.

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The **problem** addressed in this research is the lack of availability of quantitative and qualitative data based on the experiences and needs of residents of private retirement villages. The **objective** of this study is to create such data.

The research described in this report thus adds to the creation of a knowledge base that will contribute to the decision-making process of developers of retirement villages, as well as to the understanding and selection of retirement villages most suitable to satisfy individual prospective buyers' needs, thus creating directives for retirement village development.

The **methodology** used focuses on the creation of quantitative and qualitative data. A literature survey has been done to establish fundamental guidelines in support of the development of sustainable private retirement villages. Relevant literature is, however, very limited.

Quantified data regarding this specific field of study is a rare commodity. Empirical primary data generated during the research was obtained by means of questionnaires completed during structured meetings. A seminar, attended by the chairpersons and managers of retirement villages, was conducted to explore "democracy in design" information; in other words, which aspects of retirement villages function optimally, through to which might be regarded as failures.

Although this research has been conducted in South Africa, the methodology and content could be of value elsewhere. The terminology "retirement village", or "resort", or "estate", or "centre" is used synonymously in the "private retirement village" domain.

It is also noteworthy that private retirement villages in South Africa are presently almost exclusively populated by white South Africans (typical first world citizens). This is primarily ascribed to cultural differences in South Africa, where the black population traditionally has a well-developed "extended family" structure that takes care of family, particularly the young and the aged. This might change in the present-day democratic dispensation, also moving towards a more "westernised" society, set to benefit from this ongoing research.

It is to be noted that the terminology "trustees" and "body corporate" is often used synonymously. Legally the trustees are the persons, usually owner residents (not legally required) elected by the residents (they form/are the body corporate) as the "management committee" that in turn typically appoints a salaried manager – referred to as the manager of the village – to manage the village.

LITERATURE OVERVIEW

The research was conducted in a field about which very little has been published. "Sustainable private retirement villages" for all practical purposes have been in existence for less than three decades. Significant development has taken place in the last two decades. This time scale, with the resident population now having moved into average age groups around 80 years, is magnifying what is sustainable, and what is not. Very importantly, some new or envisaged elements, which might be crucial, have

not been agreed upon as yet, or tried and tested. "Sustainability" aspects needing serious consideration could be placed in a variety of compartments. One of the aspects covered in this study is health care from the perspective of "wellness" and "longevity". Financial sustainability, according to all indicators, is rapidly becoming a serious problem. The elderly simply cannot afford to sustain their lifestyle and personal care. Life-supporting services and goods are becoming more unaffordable as time passes, while needs are increasing all the time. Thus, sustainability of personal health needs, nutrition, services (utilities) such as electricity, water, sanitation, gas and general maintenance, is simply increasing beyond many of the elderly's means to afford.

Development guidelines, even if informal, in the traditional subsidised (by government and welfare organisations) "old age home" environment are well established, but these developments are fast becoming historic remnants with very little, if any, new projects being launched. The emphasis has thus shifted almost completely to private retirement villages. However, development guidelines are by no means entrenched and proven, making the developments repetitive experimental projects, unfortunately with serious and sometimes unscrupulous deficiencies entrenched. Some developments could even be classified as suffering from "criminal neglect". Prospective buyers are able to take comfort from the Consumer Protection Act (CPA) recently promulgated, which will assist them with recourse against blatant "developer non-performance". But, that still does not solve the problems associated with the creation of so-called retirement villages that are simply unsustainable. The establishment of a sustainable retirement village is well above the simple scoping of "design-it-sell-and-build-it". Enlightened retirees buying into retirement villages should hold typical hit-and-run developers accountable in terms of the CPA.

The following literature is relevant to the above:

(a) *Guide to Retirement Places* (McAlpine 2006). This guide deals with the physical location and provides concise notes on "retirement places". Although it summarises some elements, it makes no contribution to broadening the knowledge base about sustainability.

(b) *Retire Right* (Cameron 2004). This publication deals with various elements of personal and financial concerns of retirees. Although very little attention beyond financial advice is given to ensure that retirees buy into sustainable retirement villages, valuable warnings are, however, provided regarding investment risks, resale, levies, poor management, financial concerns, health care and other support. Cameron (2004:272) sounds a cautionary note: "The retirement village industry has not had a very satisfactory history in South Africa".

(c) The all-pervasive long-term affordability crisis that has to be addressed head-on is demonstrated by the shrinking purchasing power of the rand which has lost 90% of its purchasing power since 1991 (Human Action website, 2009).

(d) The bimonthly journal *Plus 50*, endorsed by two noteworthy organisations for older persons, namely GreyPower and the South African Confederation of Seniors Organisation respectively, makes important contributions towards the sustainable retirement debate. The following article references bear relevance to this research:

- Malan and Labuschagne (2009:24-27) published an article, following a symposium, with the title "Meaningful Aging – A Multi-disciplinary

Challenge". Important factors which they highlight address issues such as the behaviour patterns of aging related to biological, psychological and social processes. Social demographic issues like the erosion of traditional support structures, residential facilities, impoverishment, medical care, social and religious services, are highlighted. Reportedly already (2008) 7,5% of the South African population is older than 66, and is expected to have grown by 50% by 2021. Racial group poverty expressed as percentages of elderly persons is at 4% White; 19,5% Coloured; 6,6% Asian and very alarmingly at 56,2% Black.

- Van der Zel (2009:30-31) reports the following factors that influence longevity and health in an article titled "Creative and Positive Aging":
  - Genes
  - Nutrition
  - Lifestyle
  - Environment
  - Socio-economic status
  - Attitude and change
- Eckley (2009-2010:23-24) provides the following insights in an article: "Care of Older Persons":
  - Demographics are changing rapidly:
    - 3,7 million South Africans are older than 60, and this figure will have grown to over 6 million by 2030
    - The 80-years-and-older groups will have grown from 550 000 to 1,2 million by 2030
    - Children as a social support system is degrading for a variety of reasons
    - Mortality data indicates that older persons tend to die as a result of lifestyle diseases. Particular reference is made to inactivity; boredom; lack of "challenges" like working; and not taking charge of managing their lifestyle, health and aging.
    - There are presently about 480 independent retirement villages in South Africa that house approximately 89 000 people older than 50.
  - He identifies the following factors that promote successful aging:
    - Live and surround yourself with people that challenge you to still dream and work
    - Take care of your health
    - Take care of your energy sources, your psychological and spiritual well-being
    - Plan financially and live where the surroundings are conducive to your health
    - Ensure availability of security and health care
- Malan, Eckley and Bekker (2010:26-27) report the following, with specific reference to frail care centres, in their article "Frail-care Centres – Achilles Heel of Many Retirement Villages":
  - Developers of retirement villages incredibly often do not fulfil their undertaking to provide the "promised" frail care centre
  - Only about 2% of residents (ten years ago about 4%) actually do require the services of a frail care centre
  - Frail care centres are not economically viable below 25 fully occupied beds (absolute minimum), but the critical number should ideally be 40
  - The cost of running frail care centres is exorbitant and many residents simply cannot afford frail care if it is not subsidised

- Trustees of retirement villages are ill equipped to manage such centres
- Some frail care centres fall prey to obscure operators on contract basis
- Home-based care (in resident's own home) should be available in retirement villages

(e) Hoffman (2009:16-17) in an article "A Good but Affordable Old Age", reports that by 2030 half the population of Europe will be over the age of 50; by 2050 20% of the Asian/Pacific population will be over 60; China alone will have 300 million people over 60; and Sub-Sahara Africa 140 million over 60. The Oxford Institute of Ageing (University of Oxford) is actively studying global ageing demographics, also focusing on Africa. Hoffman (2009:17), senior research fellow at the institute, states: "With one of the highest Gini co-efficients of inequality in the world, South Africa is in a certain sense a micro-cosmos in which ageing can be studied – the ageing world in one country".

QUANTIFIED DATA PER GROUP

Primary data on the needs of residents in private retirement villages, or the shortcomings they experience, was collected in a structured fashion. Qualitative data to support this data was also collected for completeness. The questionnaires were created in table format with tickboxes for ease of completion, and respondents were given opportunities to add qualitative comments. Also see the section on Democracy in Design Workshop conducted in aid of further qualitative data collection. The actual data collected is comprehensive, but has been reduced in order to shorten the tables in this report. The data – based on either a 5-point Likert Scale, or presented as percentages, or as "yes" or "no" responses – reflects arithmetic means of the findings.

Respondents were categorised into two groups. Group 1 was easily identified, being the trustees of each retirement village. In some instances they preferred to provide a consensus-based questionnaire, as answers to some questions would be the same, for instance, "How many people reside in the village?". In the case of individual responses the arithmetic mean was used.

Group 2, representing the resident population, could not be selected by common statistical methodology as some residents are too old or frail to take part, or may have resided in the resort for too short a period of time. It was therefore concluded that the most suitable and informed responses from residents would be obtained from groups of 10 to 15 residents selected by the trustees as persons with representative views about their retirement village. Practically this methodology worked well.

This research is ongoing with surveys having been done in Pretoria, Bloemfontein and Knysna. Surveys in Johannesburg and Cape Town are being planned. The residents' questionnaire has been loosely divided into different sections as indicated in the presentation in the next section. Group A represents Pretoria (8 villages), Group B Bloemfontein (5 villages) and Group C Knysna (2 villages). The 15 resorts that have thus been surveyed house 1704 residents.

The data presented in section 3.1 was collected from the trustees and from the residents, section 3.2. The data has been reduced to the arithmetic mean per group,

ranked in order of preference (where applicable) for the dominant Group A. Corresponding results are given for Groups B and C.

Group 1: Research questionnaire and results for trustees

		A	B	C
Your home language	Afrikaans	80%	76,2%	0%
	English	20%	23,8%	100%
Gender	Male	51,4%	71,4%	50%
	Female	48,6%	28,6%	50%
Age	60-69	14,3%	38,1%	50%
	70-79	54,3%	52,4%	50%
	Older than 80	31,4%	9,5%	0%
Marital status	Married	54,4%	66,7%	50%
	Not married	8,6%	4,8%	50%
	Divorced	2,9%	4,8%	0%
	Widow/Widower	37,1%	23,8%	0%

Please indicate if the following services at your village should in your view be provided by service providers on a contract basis (outsourced), or by your own village employees.

Service	Contract basis			Own personnel		
	A	B	C	A	B	C
Security/gate control/guards	85,7%	71,4%	100%	14,3%	28,6%	0%
Catering services	79,4%	94,7%	50%	20,6%	5,3%	50%
Gardening services	55,6%	42,9%	50%	44,4%	57,1%	50%
Sub-acute care (where applicable)	76%	63,2%	0%	24%	36,8%	100%
Frail care	66,7%	65%	50%	33,3%	35%	50%
Village management	8,8%	15%	100%	91,2%	85%	0%
Administrative work/collecting levies, etc.	44,4%	85%	50%	55,6%	19%	50%
Cleaning services, buildings	25,7%	42,9%	0%	74,3%	57,1%	100%
Maintenance of buildings, etc.	30,8%	27,3%	100%	69,2%	72,7%	0%

	A	B	C
How many living units are there in your village?	127,2	97,48	99,50
How many living units in your estimation change hands every year in your retirement village?	6,09	3,70	6,50
How many residents are there in your village?	144,87	146,19	128,50
(calculated number of residents per unit)	1,14	1,50	1,29
What is the average age of the residents in your village?	81,03	78,81	76
How long (number of years) has your village been in existence?	17,34	14,29	17

It is apparently becoming more difficult for residents in retirement villages to afford frail care services. If you had the choice, when buying a housing unit in a new village, to pay about 5% more for your unit (which amount would be placed into a stabilisation fund by the developer), and to contribute about 8% of the reselling price of your unit to the stated stabilisation fund, would you be prepared to do it? Such contributions (which would be applicable to all living units in the village) would provide free, or very affordable frail care for those residents that might need it.

	A	B	C
Yes	77,1%	45%	100%
No	22,9%	55%	0%
What percentage (%) of your village residents requires long-term care, typically bedridden? In other words, of all the residents, which % will according to your estimation, and based on your experience, ever require such long-term care? Figures that are often quoted range between 3% and 5%, but it has not been fully researched.	4,57	6,50	3,50

Group 2: Research questionnaire and results for residents (Group A used as leading indicator)

		A	B	C
Your home language	Afrikaans	84%	76%	0%
	English	13%	23%	100%
	German	3%	1%	0%
Gender	Male	39%	44%	70%
	Female	61%	56%	30%
Age	60-69	11%	26%	22%
	70-79	49%	51%	67%
	Older than 80	40%	23%	11%
Marital status	Married	51%	60%	89%
	Not married	5%	7%	0%
	Divorced	4%	0%	0%
	Widow/Widower	40%	33%	11%

SECTION A: GENERAL HEALTH CARE (in order of priority above value 3,0)

	A	B	C
24-hour intercom emergency call system and support personnel	4,74	3,89	3,20
Frail care	4,55	4,39	4,40
Sub-acute care (for illness conditions, post-operative care, etc.)	4,22	3,52	3,80
Home care/nursing care in your own living unit as required	4,12	3,92	3,20
Special section for Alzheimer/dementia residents	3,91	3,79	4,70
Assisted living in main building (reside in your own room in the main complex, not necessary to be placed in frail care section)	3,78	3,47	2,00

SECTION B: EXTENDED HEALTH CARE (in order of priority above the value 2.6)

	A	B	C
Wound care and bedsore nursing in the village	3,54	2,82	1,60
Disease control for chronic diseases such as diabetes, in the village	3,14	3,12	2,20
Practising foot carer/therapist in the village	2,95	2,52	1,80
Preventative medical information services and consultancy	2,95	2,78	1,80
Practising physiotherapist in the village	2,93	3,19	2,90
Availability of a dietician's services in the village	2,80	3,39	2,60
Skeletal and bone care services in the village	2,64	3,80	3,10

SECTION C: ADDITIONAL CONTEMPORARY FACILITIES AND SERVICES (in order of priority above value 4,0)

	A	B	C
Security systems/apparatus (such as electrical fencing) for the village as a whole	4,75	4,63	4,80
Security services (such as gate control and patrol services) for the village as a whole	4,75	4,67	4,00
Close proximity of shops	4,38	3,75	4,00
Dining room with daily meals	4,33	4,01	2,90
Own village minibus service	4,24	1,84	1,50
Close proximity of churches	4,13	2,67	1,60
Prepared meals available for delivery to living units on request	4,06	2,55	2,00
Library/reading room in main building	4,05	3,58	3,80

SECTION D: GENERAL INFORMATION (in order of priority)

Regardless of the type of unit that you presently occupy, which of the following would be your first preference regarding a living unit in a retirement village?

	A	B	C
Town house (bungalow)	75%	94%	60%

Typical flat in a multi-storey building	15%	0%	0%
Hotel type complex with rooms	6%	2%	0%
Others	4%	3%	40%
Who is the owner of your present living unit?			
	A	**B**	**C**
Yourself	77%	82%	50%
Your children	6%	3%	0%
A trust	3%	2%	20%
Life right/Occupation right	0%	10%	0%
Others	14%	2%	30%
Which legal form of ownership of a living unit in a retirement village is your first choice, regardless of the form of your present unit?			
	A	**B**	**C**
Sectional title	83%	94%	10%
Full title	0%	0%	90%
Share block	1%	2%	0%
Life right/Occupation right	14%	0%	0%
Others	2%	5%	0%
What is your preference regarding garaging for cars?			
	A	**B**	**C**
Lock-up garage	80%	85%	80%
Carport	18%	10%	20%
Open parking area	0%	2%	0%
No garaging or parking required	2%	3%	0%
If you should contemplate to buy a unit in a retirement village again, would you be prepared to pay approximately 8% more for such a unit if it were designed to be energy efficient, with amongst others solar water heating; emergency lighting during power outages; better quality window- and floor tightness; floor-, ceiling- and wall insulation, etc.?			
	A	**B**	**C**
Yes	86%	85%	100%
No	14%	15%	0%
It is apparently becoming more difficult for residents in retirement villages to afford frail care services. If you had the choice, when buying a housing unit in a new village, would you be prepared to pay about 5% more for your unit (which amount would be placed into a stabilisation fund by the developer), and to contribute about 8% of the reselling price of your unit to the stated stabilisation fund? Such contributions (which would be applicable to all the living units in the village) would ensure free, or very affordable, frail care services for residents that might need it. The stabilisation fund would be under the control of the management body/trustees of the village.			
	A	**B**	**C**
Yes	69%	58%	100%
No	31%	42%	0%
If many of the above "extra" services referred to in Sections A, B and C (excluding care services) were available in your village, would you be financially able to afford it?			
	A	**B**	**C**
Yes	47%	34%	44%
No	53%	66%	56%

DEMOCRACY IN DESIGN WORKSHOP

The following data was collected during a morning workshop with the chairpersons and managers of villages in the Pretoria region. It is presented in the format of agenda points only. The preference responses of the participants (democratic evaluation of design responses) are available.

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OBJECTIVE: To determine which aspects concerning the design and management of retirement villages function well, and which are insufficient. The following were investigated for this purpose:

1 Functionality of living units:
- 1.1 Floor layout
- 1.2 Private gardens
- 1.3 Home security

2 Functionality of the following areas:
- 2.1 Offices
- 2.2 Dining room
- 2.3 Lounges and halls
- 2.4 Kitchen
- 2.5 Garages, carports
- 2.6 Parking areas
- 2.7 Care facilities
- 2.8 Sub-acute facilities
- 2.9 Public areas and passages
- 2.10 Guest house/visitors' accommodation

3 Functionality of general services:
- 3.1 Energy efficiency
- 3.2 Garden water/borehole (well)
- 3.3 Premise perimeter security
- 3.4 Gate security
- 3.5 Catering
- 3.6 Intercom
- 3.7 Emergency call system
- 3.8 Gardens
- 3.9 Maintenance problems
- 3.10 Municipal services or the lack thereof

4 General management aspects:
- 4.1 Personnel requirements
- 4.2 Office installation and equipment
- 4.3 Financial management
- 4.4 Long-term financial viability/sources of additional funds
- 4.5 Residents' long-term affordability
- 4.6 Property insurance
- 4.7 Possibilities regarding co-operative management services and facilities

5 Developers' legacy:
- 5.1 Broken promises
- 5.2 Dysfunctional aspects
- 5.3 Financial aspects
- 5.4 Statements made with general consensus
- 5.5 Practical, sustainable and affordable health care in private retirement villages?
- 5.6 Architectural conformity
- 5.7 Turnaround strategies for existing retirement villages with deficiencies

SUMMARY AND CONCLUSIONS

This research is ongoing, and further knowledge should ensue. Preliminary observations indicate that the problems experienced by the target groups in this study (private, not subsidised retirement villages) are in many respects similar to those observed in the developed world. The latter, however, are experienced in countries where governmental and other forms of support are well entrenched, contrary to South Africa where practically no such support exists.

For practical reasons the overall data that emanated from this study has been condensed to the following:

5.1 Frail care and other forms of health care are top priorities for retirement village residents.

5.2 Personal safety and security rank equally high in the stated requirements of residents.
5.3 Other supporting services and general convenience aspects also rank high.
5.4 There seems to be little testimony that a need exists for "extravagant" services.
5.5 Although the researchers are of the opinion that a total wellness approach and provision of holistic wellness facilities and concepts are very important, there are few comparative elements in existing villages that could be evaluated and responded upon by residents. It could be argued that these represent the "new challenge" in creating a holistic environment that supports longevity, wellness and financial sustainability.
5.6 Provision of practical and functional facility designs that cater for the needs of the aged are regarded as non-negotiable.
5.7 Simplex/town house/bungalow accommodation is strongly preferred, but is less affordable.
5.8 Other than in support of churches and welfare organisations, no sound reasons could be found for retirees buying residences in life right villages rather than in villages where they will be title holders. It simply does not make sense to let the capital growth mainly accrue to the "developer".
5.9 There is strong support for efficient energy and other resources.
5.10 Residents are acutely aware of the affordability crisis that faces retirees and are strongly in favour of financial modelling that will promote long-term financial sustainability and care services for their villages.
5.11 Although the first leg of this study has been conducted in what is regarded as affluent areas in South Africa, more than half of the residents cannot afford more than the fixed village levy. Practically that means that if there is no suitable intervention to provide support for what is perceived to be necessary, and "nice-to-have" items, most residents cannot afford it. This affordability crisis, which is set to worsen, includes frail care and many other forms of care and wellness which could be classified as essential.
5.12 Although not quantified in this study, it is recommended that a grading system be introduced against which the quality of retirement villages could be measured to support the creation of sustainable and functional villages in general.
5.13 There are obvious concerns internationally that the world's ageing population could present a grave problem in future. However, many sources report in parallel to this perceived eminent affordability crisis regarding the care retirees require, that many ageing people do not necessarily prefer the route of "traditional retirement". There is sufficient testimony that staying active is healthy, reduces the risk of diseases such as Alzheimer's disease, and assists in bridging the affordability crisis. Some countries are already increasing the qualifying age for receiving retirement benefits in line with higher life expectancies and national affordability. The advent of an ageing population automatically becoming a social burden could perhaps be overstated. If ageing people remain economically active, even at a reduced pace, the problem of an ageing population could be relieved in many ways.
5.14 Available data indicates that the percentage of elderly people requiring frail care in later life is decreasing rapidly despite life expectancy increasing, which also indicates that the quality of life is improving in higher age groups. These observations are worthy of further research in order to test the general

assumption that the higher life expectancy of people will automatically create serious problems. That might only be true if the ageing population also requires dedicated health care for longer periods than previous generations. Obviously the increase in numbers of the elderly carries weight, but the exact impact with all factors attached to it requires more serious consideration and research than what is available at present.

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SPATIO-TEMPORAL ANALYSIS OF COMMERCIAL REAL ESTATE AUCTIONS IN THE UK

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ABSTRACT

The commercial real estate market has witnessed a turbulent time over the past number of years as a result of the economic downturn. The auction room is an ever-present element of the market, acting as a barometer on which the wider marketplace gauges activity. Auction lots are inherently fixed in terms of space and time, with a fluctuating variable of cost. While research has been conducted to investigate the sustainability and viability of auctions, the geographic component through time has yet to be explored. This paper explores how commercial real estate auction data from the UK can be fused with other forms of geographic information and analysed in a spatio-temporal context using GIS techniques. The paper concludes by considering the impact that the geographical distribution of commercial real estate auction lots has on the sustainability of the auction market.

Keywords: auctions, commercial real estate, GIS, spatial analysis.

INTRODUCTION

The turmoil experienced by the economic downturn has had a deep impact across many sectors of the economy and the Commercial Real Estate Market is no different. The past number of years has been some of the most challenging for the industry as its tries to remain buoyant in a subdued marketplace. The auction room as a fountain of liquidity in this market offers transparency of transactions, as well as a window into market activity levels. Total commercial auction sales for 2010 were £1,000,739,341 reflecting only 43% of the 2007 total of £2,314,037,767 (EIG, 2007-2010). This has led to a deep impact in the industry with many auction houses realigning, retreating or being made redundant.

The use of simple quantitative techniques in the analysis of commercial real estate auctions and the property market in general is in wide spread use. In a time of uncertainty for the market amongst unprecedented economic challenges, the analysis of the data using an alternative technique may lead to the exploration of some interesting findings, which can perhaps shed light on the current performance and future direction of the market.

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LITERATURE REVIEW

Relevant academic literature on real estate auctions in the UK is severely limited and confined in the main to professional publications. There are a number of papers that flirt with the auction topic but not wholly in the context of real estate, let alone commercial real estate. It is this finding in itself that has necessitated the need for further research in to the UK real estate auction market. The author has conducted research in this area for a number of years and previous papers by Galvin et al. (2009, 2010) have discussed the Commercial Real Estate Auction Market in a variety of approaches including sustainability and viability. This paper is utilising a new approach in analysing auction data. While the techniques are not new in entirety, their application to real estate data is limited and non-existent regarding auction data.

The use of Geographical Information Systems (GIS) for analysing spatial distributions of geo-coded data has been widespread in the fields of crime (Zhong H. et al., 2011) (Chainey & Ratcliffe 2005), health (Bell et al. 2006; Widener et al., 2012), urban planning and ecology but there is little evidence to suggest that GIS has been employed for the analysis of commerical property auctions. A concise definition of GIS is put forward by Burrough and McDonnel (1998), GIS is defined as "a powerful set of tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes". GIS provides the ideal means to store, manipulate, analyse and visualise the data collected using these techniques, especially when considering the spatially varying nature of the data proposed for commercial real estate auctions. The application of GIS in real estate research is not a new concept as Wyatt (1996) explored its use as a tool for property valuation. While commercial real estate auctions have not been analysed in terms of a statistical geographical context, livestock auctions have been examined by region and catchment area (Saizen et al., 2010; Wright, et. al., 2002) and viability explored.

Point Pattern Analysis which is the spatial analysis of geo-coded point events or phenomena has been widely exploited in many domains. A variety of methods built on spatial statistics have been developed for identifying 'hot spots' or clusters of point events. Kernel Density Estimation (KDE) is an established and accepted 'hotspot' technique for the analysis of point data; however it is under exploited in the area of real estate auction analysis. KDE is a grid raster based type of analysis and works by fitting a smoothly curved continuous surface over each point event. Subsequently grid cells containing no points have interpolated values. The density at each output raster cell is calculated by adding the values of all the kernel surfaces where they overlay the raster cell centre. The kernel function is based on the quadratic kernel function described in Silverman (1986, p. 76, equation 4.5). KDE is one of the most popular methods to be used for analysing a point distribution (Bailey and Gatrell, 1995) (Silverman, 1986). Some KDE tools for point and line pattern analysis are available in commercial GIS software such as Spatial Analyst Extension (ArcGIS) and more specific spatial statistical analysis software, such as CrimeStat (Levine, 2004).

Thematic mapping is a GIS technique used to visualise and analyse aggregated geographic data that is typically contained using census or other polygon boundaries. It is useful for obtaining a general overview of spatial distributions. Caution needs to be taken when deciding upon the chosen boundaries. For the purpose of this paper UK Local Authority boundaries have been used due to the large geographic extent of the auction dataset.

Spatio-Temporal analysis lends itself particularly well to commercial property auctions due to adding the dynamic of 'time' in a spatial context, which in such a changing market place can not be omitted from the model. The use of Spatio-Temporal Analysis in a real estate context although a recent application, has been previously utilised in papers mainly focusing on China's booming economic growth and related urban sprawl (Seto & Fragkias 2005).

METHODOLOGY

The data was obtained from the Essential Information Group (EIG) which specialises in providing data for the real estate auction industry. A dataset was distributed at the completion of each auction which contained all the information which then had to be processed in excel and geo-coded using separate Postcode data which is the essential link when mapping the data in a GIS. When only the first part of the postcode is given for example, CF38, then the location plotted will be the centriod of that postcode area. The mid 2009 - 2010 data contained the full postcode for the auction properties which enabled a level of far greater accuracy when plotting the properties.

The data supplied was from auctions that sold mainly commercial real estate during the time period analysed. During the downturn in the market, some auction firms which traditionally traded exclusively in residential or commercial auctions sold both commercial and residential properties in their auctions to boost their auction catalogue. Therefore firms chosen were done so by mainly selling but not exclusively, commercial investments. The breath of possibilities for the use of this technique and the varying data is discussed in further research.

All data storage, manipulation and analyses were processed using the leading commercial GIS package ESRI ArcGIS 10. The two main techniques employed for the analyses were thematic mapping using quartile classifications and the spatial analytical technique of hotspot analysis using Kernel Density Estimation (KDE). Chainey et al. (2008) compared KDE to other methods using a prediction accuracy index and concluded that KDE consistently produced the best hotspot maps for predicting future events. For the purpose of this paper a hotspot can be defined as a geographical area of higher than average occurring real estate auction lots (sold or unsold).

During the time frame of 3 years that was used (2008-2010) the auction industry underwent some changes and takeovers. Firms closed and other firms taking over whole auction teams for rivals. Therefore the firms active within the market over the 3 year sample are not consistent, although many are reincarnations.

ANALYSIS & DISCUSSION

The data utilised in the research was a large sample taken from the leading commercial auction houses in the UK. Table 1 outlines the distribution of auction lots amongst the leading commercial real estate auctioneers. The commercial real estate auction market in the UK is dominated by about 10 firms, and of those Allsop Commercial, having the largest market share increasing from 35% in 2008 to 45% in 2010. The table also identifies the firms that have changed over this short time span, illustrating the flux that the industry in currently experiencing. The majority of these firms hold residence in London from which they offer a national service.

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Table 1 - Auction Lots by Auctioneer

Auctioneer	**2008**	**2009**	**2010**
Acuitus	0	0	188
Allsop Commercial	697	745	773
Cannon Capital	0	0	61
Colliers CRE	340	128	72
Colliers International	0	0	30
Cushman Wakefield	341	238	183
Erinaceous	65	0	0
Jones Lang LaSalle	292	231	49
King Surge	75	188	113
Lambert Smith Hampton	0	0	56
Savilles Commercial	171	104	157
Total	1981	1634	1682

Table 2 illustrates the status of lots that went to auction. Various rationales would have led to the possible outcomes that are achievable when a property goes to auction and many factors influence bidding activity. For example, on the lots that failed to usher a single bid, there could be a multitude of reasons why this was so, from missing information in the legal pack, the condition of the property or the conditions of sale. For the purpose of this research the main focus will be on the spatial distribution of sold and unsold lots. Between 2008 and 2010, the amount of commercial lots that went to auction dropped by 17%. However, during that time the combined amount of sold and unsold lots remained stable at 79% of lots offered, with the sold fluxuating between 50-55% and unsold 23-29%.

Table 2 - Status of Lots at Auction

Status	**2008**	**2009**	**2010**
Total Auction Lots	1981	1634	1682
Conditional Sale	1	0	0
No Bids	42	18	15
Refer to Auctioneer	12	2	1
Sold	999	904	862
Sold Post	43	26	21
Sold Prior	107	163	127
Unsold	578	388	474
Withdrawn	199	133	182

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Spatio-temporal Analysis

Figure 1 shows the hotspot analysis of sold commercial real estate auction activity in the UK from 2008 to 2010. Although the national auction houses that dominate the market operate out of London, the spatial distribution illustrates that the properties are widely located across the UK. It is obvious for each year that there is a hotspot cluster of sold commercial properties present in London, however it is clear from the maps that there has been a definite shift in distribution. In 2008 it is evident that there are many more hotspot locations other than London, with similar density being achieved in South Wales, the Midlands and the North West. This is a diminished case in 2009 and by 2010 it is clear that the majority of sold commercial properties were centralised in the Greater London area. When using the KDE technique to examine unsold lots (Figure 2) relative to the sold lots, this trend remains relatively consistent over the 2008-09. However, in 2010 London clearly was the investment market of choice reflecting its status at the hotbed of the UK economy. Furthermore, the geographic concentration of sold and unsold lots for 2008 is relative, 2009 could be classified as a transitional year, where there are slightly more clusters of unsold lots to sold lots. The 2010 map illustrates that there are more hotspots of unsold commercial property lots than sold lots.

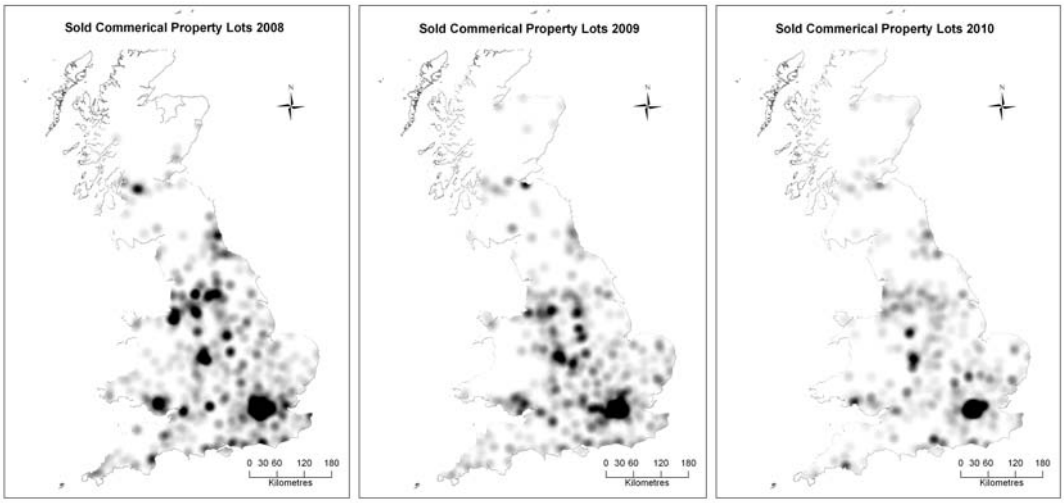

Figure 1 KDE Sold Commercial Property Lots 2008-2010

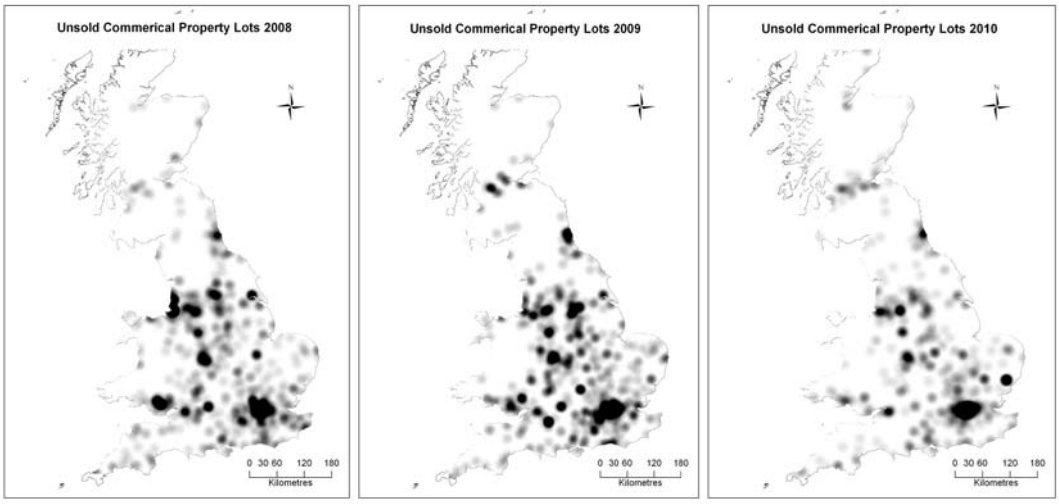

Figure 2 KDE Unsold Commercial Property Lots 2008-2010

Thematic Mapping by Local Authority

While KDE has successfully identified hotspot clusters of sold and unsold commercial property lots in the UK, the maps are somewhat dominated by the quantity of lots available in Greater London, therefore it is important to use thematic mapping to gauge an understanding of the distribution at Local Authority (LA) level. As London is divided into much smaller LA boundaries, it is evident that there are some interesting findings in other parts of the UK (Figure 3). For example, in 2008 featuring in the top 10 rank of LAs with the most sold commercial real estate lots, Greater London LAs only appeared in 4 instances, with Rhondda Cynon Taff containing the most sold commercial property lots in the UK. Other featured LAs included Ellesmere Port and Neston (Cheshire), Birmingham, Leeds and Swindon. By 2010 sold commercial property lots were most certainly centralised in London, with 7 London LAs featuring in the top 10 rank of areas. The upper quartile of unsold lots (Figure 4) featured LAs outside of the Greater London area such Ipswich (England), Swansea (Wales) and Highlands (Scotland) illustrating a more even distribution.

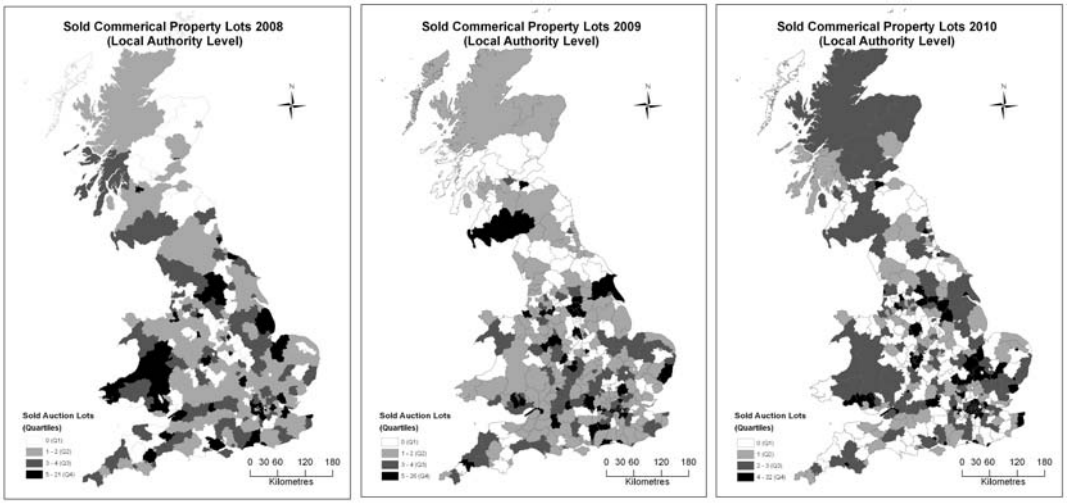

Figure 3 Thematic Mapping Sold Commercial Property Lots 2008-2010

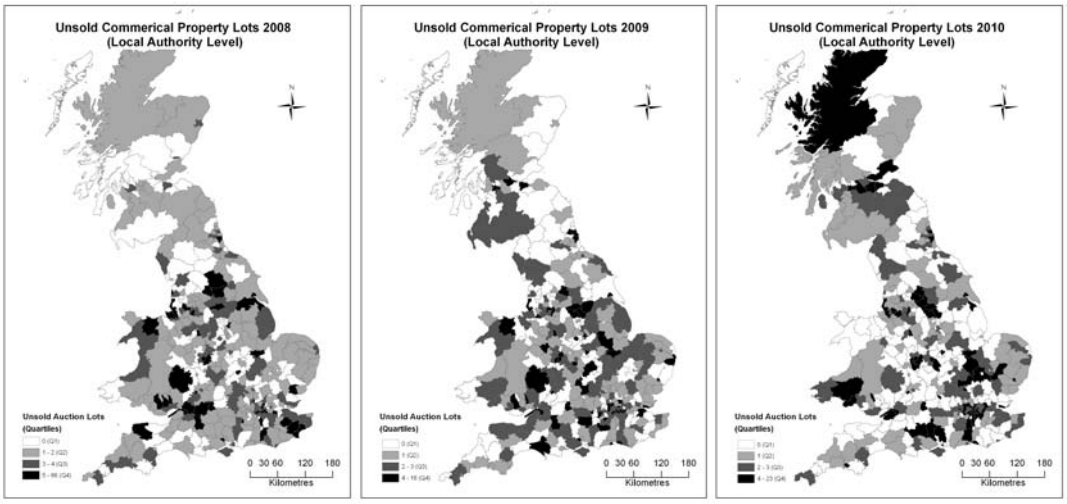

Figure 4 Thematic Mapping Sold Commercial Property Lots 2008-2010

CONCLUSION

This research has clearly demonstrated the potential of using GIS and Spatial Analysis techniques for the exploration of the geographic distribution of commercial real estate auctions. Location and time being the essential elements in the valuation of real estate, it is a logical progression to integrate spatio-temporal mapping into the knowledge pool of information available in the market. In an ever-changing market such analysis is crucial in predicting future trends and focus, for vendors, purchasers and the auctioneers themselves. As the market has changed over the 3 year period, with a decrease in lots offered, there was an increasing lack of demand for properties outside of the Greater London area. This is reflective of the concentration of investment in the capital, while highlighting investors caution to investing outside of the central economic hub in an uncertain market and economic climate. A sustainable auction market needs an increase in investor demand beyond the Greater London area.

Future research will include using other innovative GIS techniques to fully interrogate the drivers of the changing auction market place such as geographic regression and the Getis-Ord GI* statistic. Additional analysis and mapping could be undertaken by investigating tranaction yields and price, auction lot catergorisation by type (retail, industrial & office) and classification (prime, secondary & tertiary). This would give more in-depth understanding of the sub-categories within the market and their performance to market stakeholders.

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A NEED TO INNOVATE THE DUTCH BUILDING REGULATION

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ABSTRACT

Increasing dissatisfaction with the regulatory burden, with the (municipal) system of quality assurance and the general loss of knowledge and experience on operational levels led to two Governmental Committees who presented in 2008 their conclusions and proposals. For instance private certification of the building permit procedure, and to concentrate the knowledge of municipalities in regional intermunicipal bodies. These proposals will however not change fundamentally the attitudes and behaviour of the parties in the building process, owners and users of works. Experiments since show only increased costs and liability.
Also more fundamental questions were raised about quality assurance and responsibility in a market driven construction sector. Should the national building regulation set a minimum standard for all relevant aspects because of market imperfections? Or is self regulation feasible. And if so, will it be effective without supervision by an authority?
In 2011 three new studies were commissioned by the Government to address perceived problems. Two subjects were the economic effects of changed regulations, the and the cost effectiveness of existing building regulations. The third integral study, executed by Foundation Expertcentre Regulations in Building (ERB) was based on the weaknesses in the knowledge circle of the building sector. It led to proposals to redefine responsibility and liability for all parties.
This study states that by an effort of yearly € 100 million, unnecessary costs up to € 1 billion can be avoided and a real quality push will take place in the building and real estate markets.
This paper discusses the three studies and the given proposals.

Keywords: deregulation, education, liability, system innovation.

INTRODUCTION

The Dutch Building Decree has been under discussion for decades. Clear building rules and regulations form an important, even an essential link between building

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practice and society, aiming primarily at the availability of safe, healthy, usable and sustainable buildings. How effective building rules and regulations are depends largely on their practical applicability, costs and the extent in which they allow building innovations.

With its Building Decree 1992 Dutch legislation took an important first step a system that meets these objectives. As opposed to the traditional building regulations, the Building Decree does not prescribe in detail how to build, but indicates, the required performance. This system leaves space for the introduction and application of fresh, innovative solutions.

Now, almost twenty years later, the building regulations have been changed three times fundamentally, initiated by deregulation initiatives. The last one is more and more based on the idea that governmental regulation can be skipped in the belief that market forces will ensure a good performance, in the whole building sector, also for the long run.

Although the Building Decree has proven to be successful in many aspects, various problems have emerged which appear to be structural in origin.

ERB published its first, overall analysis and vision (Scholten, et al.2008) in 2009. One of its conclusions was that the end user – who, as the owner of a building, is legally accountable for it to meet the rules and regulations set – is represented too feebly in the building process, and often does not even play any role at all in the decision-making, especially not in the formulation of regulations. Because of this, the end user could in practice become the loser. As a result ERB assigned a group of experts and scientists to further investigate this issue and to come with a remedy to this undesirable situation.

Other conclusions were that in the public and private sectors two separated circuits of knowledge development took place, and that the building regulations in their present form insufficiently warrants that public objectives are realized.

In the end of 2011 a quick scan study was realized commissioned by the Government:

to describe the desired change in public and private roles of involved parties in the building process and in the management and maintenance of real estate.

to sketch a robust future picture of the development and content of the building regulations and the role of the different parties in that process by focusing on the protection of the non professional end-user.

to change the building control process and the process of assessment of the performance of existing stock to strengthen the position of the end-user in such a way that the realized performance fulfills the regulations and that at the transfer of real estate by owner or tenants the performance will be transparent and guaranteed.

THE PRESENT SYSTEM

As a reaction to the abominable bad housing of city immigrants in the second half of the 19th century the Netherlands introduced the Housing Act in 1901. From then the municipalities were responsible for the drawing up and enforcement of regulations in the form of local building codes. In the 20s and 30s of the 20th century, the Housing Act advanced the construction of good - and still attractive - dwellings.

After World War II building contractors and developers operated more and more nationwide. They were confronted with all kinds of different and inconsistent local regulations. In order to to rationalize the building process, countrywide uniformity was required. As a first move the Association of Dutch Municipalities issued the

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Model Building Bylaw. But many municipalities kept adhering to their own building regulations and the call for national uniformity became stronger.
In 1982 the Lubbers-1 cabinet took the initiative that finally resulted in the 1992 Building Decree. The Housing Act stated that from then on municipalities, fire brigades and utility companies were no longer allowed to issue regulations supplementary to or deviating from the Building Decree.
This first Building Decree had a completely different structure. In the old system, the building regulations described specific solutions to many regularly occurring construction problems; innovative solutions were formally not allowed. As the Building Decree states the performance required of complete buildings, constructors could apply both existing standard solutions as well as new, equivalent or better .
Between 1992 and 1998 the government worked on a second edition of the Building Decree which was never enforced. In 2003, the presentation form of the Building Decree was changed at the request of the market into the so-called tables legislation. However, the Dutch government simultaneously introduced a new modeling principle of works that was not in conformity with the experience of neither the construction partners nor citizens.
On April 1st of 2012 a revised Building Decree 2012 came into force after a long development struggle. It integrated elements of Building Decree 2003, of 418 municipal building bylaws, the Decree on fire safety structures in use and the Decree on road tunnels. The political goal was to reduce more than 25% of the volume of all clauses and to diminish the freedom of local authorities to decide about exemption of requirements for renovations.
Since its publication in 1991, the Building Decree has now been changed 31 times. Often miner changes and two mayor revisions as described above.
The Building Decree does not cover the whole spectrum of regulations relevant to building. For specific buildings and safety and healthy rules, the specialised Ministries published their own technical regulations.
Besides these, EU regulations for construction products were introduced, due to the required free movement of goods and reduction of use of energy.
In order to reduce the burden of too many regulations and organisational fragmentation the Dutch government recently decided to implement three important measures:

a) one ‘environmental counter’ for the dealing with ‘environmental’ related permits (the General Physical Environmental Rights Act), but at the start of the Government Rutte I in 2010 a more rigid law reconstruction in the Environmental area is foreseen;
b) bundle all knowledge at the enforcement level by combining the responsible local services at regional level, implementing the advice of the Mans Committee (VROM 2008);
c) organize the fire departments regionally (Act on Safety Regions).

A NECESSARY REVIEW OF THE SYSTEM

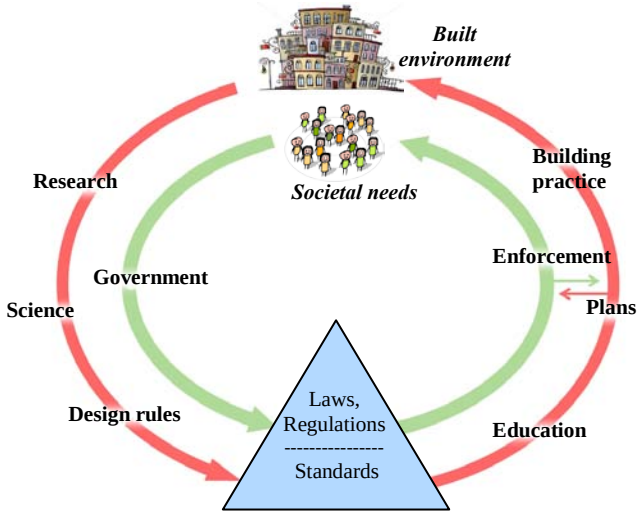
The three recent measures are administrative and organizational answers to problems that are rooted deeper. Both, the public legislation and the privately developed system of Building Standards form part of a knowledge system that is necessary to realize and manage safe, healthy and sustainable buildings. That system should function properly, which is not the case at present. Regulation is more effective, when it is developed in line with this knowledge system. Everybody involved in buildings,

construction and its management, must be able to properly understand, interpret and apply the regulations.

This knowledge system should also facilitate possible adaptations and the development of new regulations. Of course, these regulations should comply with the practice of design, construction and use. Lessons learned from practice should in turn lead to research and improved regulation. Attention must be paid to the transfer of knowledge as well as to the restructuring of the regulations.

The cycle of knowledge

The skills of designing and constructing good and reliable buildings are rooted in building science. This has largely developed empirically and is continually developing further. With a view to practical applications, scientific knowledge has been incorporated in design regulations, governmental rules and regulations and Standards. We may assume that buildings are sufficiently safe, healthy and sustainable when architects adhere to these regulations. Naturally, the same counts for owners and users when managing and running their real estate. Should they not do so, we ought to change the regulations or stimulate people's adherence to the regulations. Occasionally, or in case of technological innovations, people should be able to deviate from the details in the regulations without necessarily endangering safety, health or sustainability. We have depicted the process outlined here as a circle of knowledge (see figure 1):



The *public* learning track (green): public requirements are translated into rules and regulations through legislation, enforced according to public law by means of a licensing system, general terms and conditions, or sanctions recorded in the Housing Act, Municipalities Act and the Provisions of administrative law;
The *private* learning track (red) runs from research and science, through technical specifications and known solutions which are transferred in training programs, leading to professional practice. Some of these specifications and agreements have been laid down in Standards and assessment guidelines.

Figure 1. Knowledge circle (Scholten, et al. 2010)

Building regulations combine the two tracks to become a crossroads. Knowledge of Standards and their background is also essential for enforcement, and knowledge of rules and regulations is just as important for education and training programs.
On the basis of the ideal model we are able to clearly illustrate the practice related hitches. Figure 2 charts these hitches.

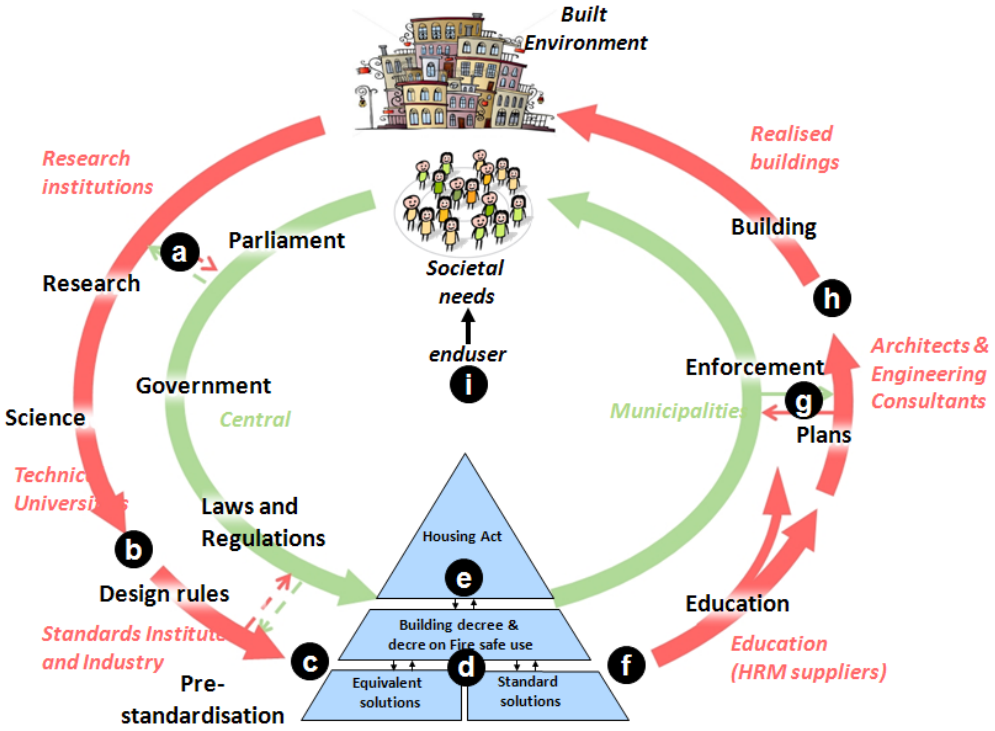


Figure 2. Hitches in the knowledge circle (Scholten, et al. 2010)

The first general problem is that the various actors in the private-law circle of learning work totally independently from each other. Universities, research institutes, schools for professional training, commissioning clients, designers, engineering consultants, building contractors, fitters, suppliers and consumer representatives, they all adhere their own policies, focusing specifically on their direct self-interests, and without much coherence.

The next problem is caused by both a highly fragmented sector and the fact that not a single party individually obtains a competitive advantage from investing in the development of communication systems and therefore chooses not do so, however these systems are necessary to structure and improve mutual understanding in the sector. Centralised communication systems are no–one's priority, and no 'central market superintendent' exists who could organise this.

And then there are other factors. We refer to the characters in the black dots of figure 2, described in (Scholten, et al. 2010). We summarize the importing ones. In order to make public-law rules and regulations and private- law agreements match, the two learning tracks on the left-hand side should be linked up with each other. At present there is no interaction whatsoever.
Standardisation must be based on research. The performance requirements must be based on measurement, determination or calculation methods. At present, unfortunately, many terms and conditions, and Standards are insufficiently based on science. Due to the lack of proper financing, universities have little interest in the methodology and modeling necessary to formulate rules and regulations. The technological institutions such as TNO (Netherlands Organization for Applied Scientific Research) largely depend on occasional commissions from the government and industries. This is the reason why they miss the long-term stamina necessary for the development of scientifically sound rules and regulations or Standards.

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The knowledge on which the development of regulations and Standards is based has been insufficiently recorded and managed in the present system. After the successful completion of a regulatory project, everybody should be able to easily find the relevant background information with a view to clear objectives and an unambiguous interpretation, and support of the equivalence of possible, fresh solutions. Now, this knowledge seems to ebb away to such an extent that even the responsible bodies themselves do not always understand their regulations.

Individual private-law regulations, such as Standards, have been drawn up based on different disciplinary backgrounds, for instance: by constructors, experts in fire safety, and those in building physics or materials specialists; also European standards use other words than the Dutch regulator; so these regulations do not match nicely. One result is a differing and inconsistent use of language. As the Building Decree (2012) refers to such regulations, unavoidable inconsistencies develop in legislation. The legislator's use of language is not that of the standardization committees, while neither speaks the language of the man on the building site the performance approach requires a level of abstract thinking which is not used on the shop floor; specialists with secondary education only understand problems by way of practical solutions. Would regulation be consistent and translated in shop floor language, the correct application of regulations would improve greatly.

The scope of application of building regulations should probably be extended. According to the original Housing Act, building rules and regulations were meant for the safety and health of the users of a building. Later, as an effect of these, regulations were added with a view to its usability and energy efficiency, later followed by accessibility and sustainability and by April 2012 also by fire safe use, demolition, safe maintenance en sustainability. Up to now, economic and cultural aspects and the prevention of criminality have been included only to a small degree. However, the regulations which have to promote the well-being of construction and aid-workers, such as firemen, have been laid down in the Law on Conditions at the Workplace; one can only find them implicitly in building regulations. Although the construction industry is one of the most dangerous, unhealthy and energy-consuming economic sectors. Surely, a building application or process should not only meet the building regulations, but also satisfy the Commodities Act: elevators and appliances), the Environmental Management Act, the Nuclear Power Act: ionization alarm, Police Act, Records Act and the Law on Conditions at the Workplace. With such complexity it is not surprising that people experience regulations related stress.

Rules and regulations only form a minor part of the curricula in secondary and tertiary professional education and universities. This creates an important gap in knowledge both within industries and within law enforcement organizations of the government. It seems as if people no longer see how closely the administrative and building laws as well as technical regulations are connected.

Preventive assessment to meet public law is done only in the design stage of a building. So, one cannot be sure that buildings realized actually comply with the relevant regulations.

In today's building processes the end user, often the owner (to be) of a building, hardly plays a role. As the end users often are parties differing from the commissioners of buildings (the developers and investors), their specific interests will generally be insufficiently represented in the design and construction stages. Therefore they will have to rely on the public rules and regulations to protect their interests. Many commissioners completely ignore many kinds of aspects that, for a society, are desirable and beneficial in the long run – think of the accessibility of

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buildings for persons with functional limitations, or the adaptability to various other uses of a building. If these requirements have been carefully dealt with in their design and construction, the layout of buildings might have to convert less often, the risk of vacancy might be lower, and early demolition due to their being unfit for purpose might be scarcer. The only way in which to realize this societal goal is for the government to list minimum regulations and enforce them.

PROPOSALS FOR SYSTEM INNOVATION

Starting point is the enforcement of regulations whose societal usefulness has been proven. To diminish the burden of overregulation we can for each aspect present the rules on three different assessment levels. That is needed for three areas of application: the newly built buildings (construction works); the renovation/-refurbishment/transformation and the existing stock. For each of these areas an own set of objectives and rules might be necessary and logical.

Starting point should be for all sub aspects that the objectives of regulation are quite clear and are discussed between all parties concerned, not in the least with the end-users, and are formulated clear and concise. This is functionally a governmental task and should be taken up before anything else.

The translation of the objectives into regulation for constructions and buildings is clearly a task of the professional market parties.

A first assessment level is meant for easy elaboration of ‘standard solutions’. We assume that possibly 80% of the building plans or existing buildings are or consist predominantly of ‘standard solutions’. The middle level more or less resembles or would be an improved Building Decree 2012, that focuses on performance. The proposed third level concerns building works in which unconventional and innovative solutions are to be implemented, using a probabilistic approach in assessment.

Should an applicant differ in opinion on whether a proposal meets the level of the standard solutions or the level of the ordinary assessment according to the performance requirements of the Building Decree, the third level would then provide the possibility of assessment according to the objectives regarding safety, health, usefulness, energy efficiency and sustainability. In that way discussions with regard to technical content need not end in judicial disputes.

For many people the introduction of these two new levels will substantially diminish the burden of overregulation. By standard solutions one could implement the greatly simplified regulations instead of those of the Building Decree 2012. While, at the third level, one can judge innovations against the the formulated objectives. outside the known territory of solutions and construction rules.

It is in no-one’s interest to enforce regulation that is not well understood. The three level structure will improve the practical use of the regulation and will promote the legislators real objectives: the enforcement of safety, health, usefulness, energy efficiency and sustainability. That is how regulation is linked with objectives.

Because of the lack of knowledge the development of the objectives and structure of three levels and three areas of application should be prepared by a "Knowledge Institution", financed by the Government and the market parties together (PPP). In this institution the few experts there are at the moment will join forces to organize and prepare the outline of the objectives and to oversee the development and elaboration of the structure of regulation. Within the Knowledge Institution all data behind the regulations will be concentrated and stored, accessible for all parties concerned, for now and in the future.

ERB proposes also to improve the safeguarding of the regulation related knowledge. Together with all those involved in the building process - from science, knowledge institutes, education, architects and engineering consultants, to the actual builders and the real estate sector - we must try and form a secure chain of knowledge with properly linked up sub processes. Only with a properly functioning knowledge system can we rely on the building sector to meet the objectives which we may expect from it. The foreseen Knowledge Institution will form the focal point.
Procedural innovations are required. We need to attune the three assessment levels. The accepted standard solutions will be assessed according to the performance requirements as laid down in the second category and the question whether the performance requirements themselves meet the objectives set, is answered by means of the risks approach which we will apply in the third category.
The elements which the three levels share at a generic level: objectives, risks models, user models, functional models and performance requirements, prepared by the Knowledge Institution and discussed with all parties concerned.
The general structure of rules and regulations as presented below, in figure 3, has been depicted in the form of the grey triangle. This part of the structure ensures that the system remains consistent, also when objectives change or new objectives, rules or constructions are introduced. The parts relevant to applicants and assessors are represented in blue.

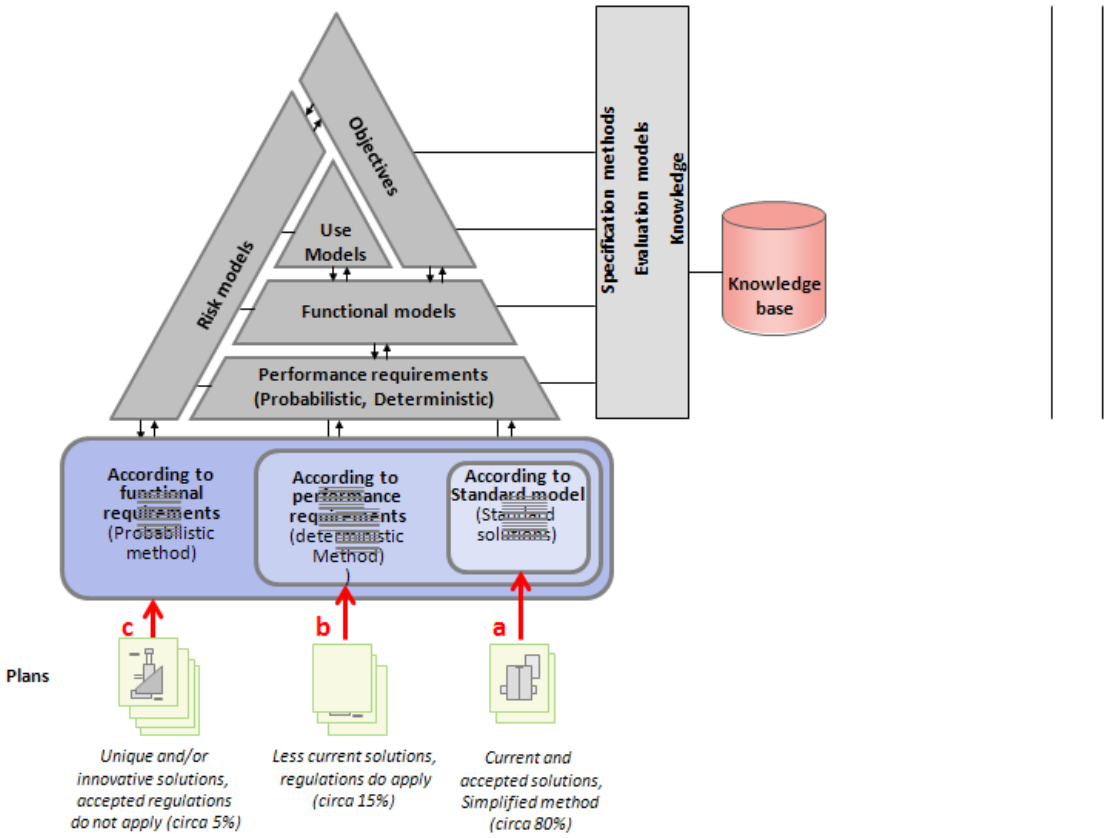

Figure 3. Presentation of the firm structure of development of building regulations (Scholten, et al. 2010)

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Explanation of captions used in figure 3.

Objectives. Regulation must be the outcome of a single coherent system of objectives. These objectives are the foundation of the regulatory system and should be well defined and written down.
Risks models. Absolute guaranties for safety, health and sustainability cannot be given. Objectives always deal with *possibilities* and *risks*. They deal with the possibility of collapse, the risk of permanent physical injury or death, and the possibility of environmental damage. The present regulation often provides strictly limited values for these possibilities and risks. Does it mean that exceeding these limit values immediately results in unsafe and unhealthy situations or limited sustainability? Depending on varying circumstances or the use expected, a building may still, in an acceptable way, meet the objectives laid down.
That is why we will again have to standardize the whole system of regulations, standards and limit values according to the objectives using risks models and the theory of probability. These models must become an integral part of the regulatory system. This too would greatly simplify regulation.
User models. We can only translate objectives into specifications for buildings if we also know how these are going to be used and who their end users will be. Models are necessary because of the variation of use in practice. That is why there is a need for realistic rules and regulation based on *user models*. By projecting these user models on the model of a building, in terms of floors, working spaces and partitioning elements, we then can list functional and performance requirements.
Functional and performance requirements. Functional requirements describe the requirements of a building in a functional sense. The performance requirements for a building and its parts depend on their function and use.
Modifiability. Naturally, the rules and regulations system reacts to ever changing opinions in the society. In the past decade, for instance terrorism, climate change and sustainability moved to top positions in agenda. Undoubtedly, new requirements and objectives will be added in the coming decades which cannot be foreseen for the moment. We should be able to change the rules and regulations as easily as possible, with minimum economic effects for users and real estate managers, while retaining previously acquired rights.
Knowledge. Many rules are clear-cut. But it is not always clear why certain rules exist or why others *don't*, or why specific terms are used. Often, the persons involved have stored this background knowledge in their minds, but it is not at all or hardly available to third parties. That is why this knowledge has to be publicly recorded and everybody will be able to properly interpret and apply this.

The government wishes to withdraw from markets that might just as well be left to trade and industry, as underlined in the report of the Dekker Committee *'P*rivate whenever possible, public whenever required'.

Differing from most of the other industrial sectors, the knowledge process in the building sector is highly dispersed, as has been shown earlier and depicted in figure 2. Most of the parties only take responsibility for their own part in the process; nobody feels any overall responsibility. The chain of responsibilities is poorly organized in the building sector and the process highly fragmented. This might be different in other countries, but it is the case in the Netherlands. We are highly dependent of the smooth cooperation of all parties. This has its advantages but also many disadvantages.

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The system of regulations and Standards forms an essential link in the knowledge process, so we should continue to invest in it for future development and maintenance. However, that does not happen sufficiently. In figure 4 we have indicated several points of necessary improvement in the knowledge cycle.

The present public system of assessment against building regulations is aimed at the granting of an "Environmental" permit in case of a construction or renovation project. But the authority will never be responsible and will never guarantee that the building fulfills the regulation. The authority does not have the duty nor the capacity to check the whole building process. Many people have the false hope that the Authorities will guarantee that the performances of the building will be in line with the regulations and the market wishes. Reality is that most of the buildings do not fulfill the regulations, a lot of mistakes are made and that contractors do not feel the responsibility en liability. They say „we have a permit and it is accepted by the Authorities".

The owner of real estate is responsible that the building will be in line with the regulation. The Authorities should issue penalties in case if non compliance. But the Authorities do not have the manpower and the knowledge to do so. In reality we don't know whether buildings comply or not. The owner doesn't know what the performance is of his real estate, nor the requirements. When transferring to a new owner or tenant no one knows what quality is sold or rented.

To break through this false chain we propose the following:

- A technical assessment of the construction project will be no longer be necessary on beforehand, but just before occupation of a building it should be clearly stated and documented by a recognized, independent body, that it meets the regulation; if not the use of the building will be forbidden; in the environmental permit this clause will be standard implemented. How much documentation is necessary depends on the level of regulation that is applicable (simplified solutions, performance based clauses or probabilistic methods).
- The regulation for existing buildings will be based on the Civil Law so that liabilities are clear and people can submit objections and complaints at the Civil Court Chamber; experts of the Knowledge Institution can advise the Court on the technical content.
- When transferring real estate (sale or rental; conveyance) a guaranteed documentation of actual performance will be handed over for which the seller or landlord is liable;
- All parties involved, also the normal man in the street, can complain at a new Body in case of unsafe or unhealthy building in the neighborhood.

By changing the system in this way and by changing the content of the building regulations and the process to develop and maintain the regulations as mentioned before, self regulation of the marked will become possible and a knowledge push will take place. All parties concerned will probably take insurance so they can bear their responsibilities and liability. Not the Law dictates the duty to insure, but the market system will realize that by itself. That also will strengthen the quality chain. This innovated system will give a upward impulse to realize real performances to the level that the market expects. This system will only function when the knowledge chain is closed.

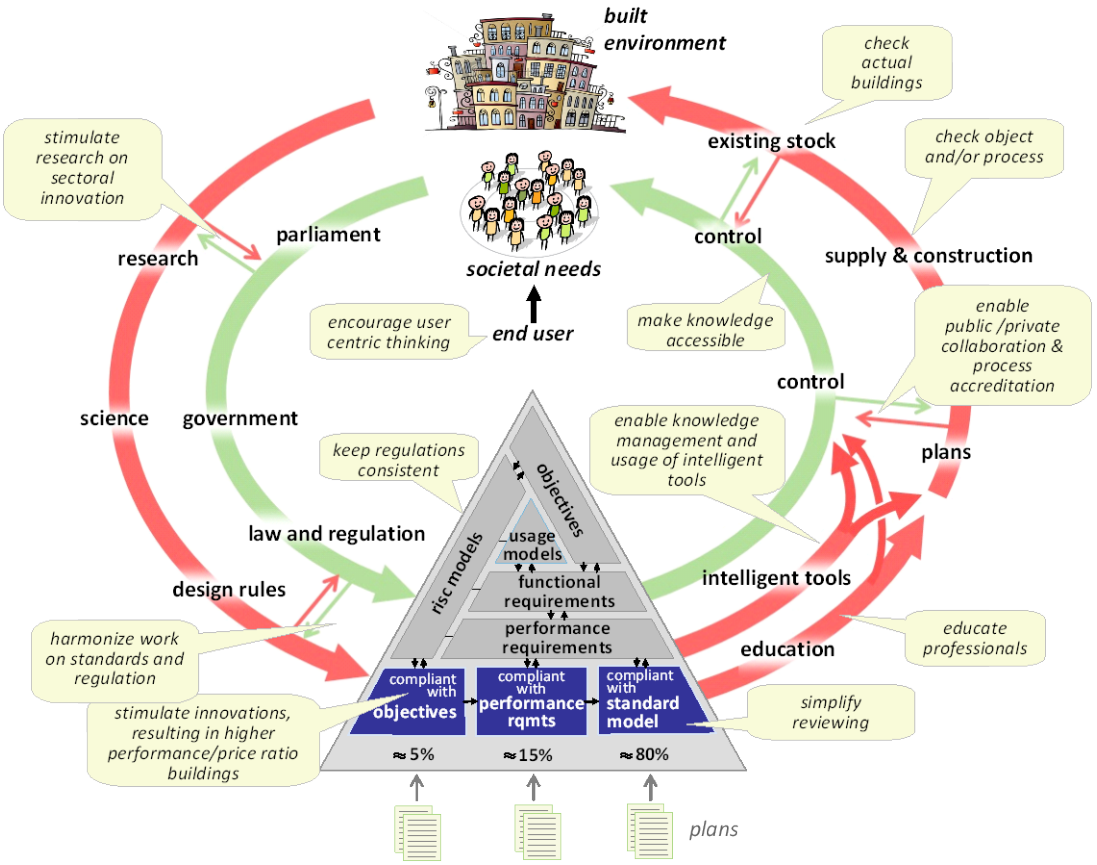

Figure 4: Vision on future development of building regulations in closed and linked public and private law chains of knowledge (Scholten, et al. 2010)

The implementation will create new functions. Acknowledgement should be organized for independent technical-legal arbitration, so that for parties that have a conflict on technical points, the dispute can quickly be settled on technical-legal arguments. The formal road of objection and appeal according to the General Administrative Law is much too cumbersome for this and can be evaded.

Furthermore, knowledge should be easier accessible and actively promoted through training, publication, the internet and knowledge systems. Thus transferred to professionals in the building chain as well as to the law enforcement organizations.

Moreover, emphasis could shift from design to process assessment, and possibly to process certification. That is to cover the complete process from design to the building process, including quality management and guarantee after acceptance/completion. This quality related thinking (ISO 9001) has been accepted in many sectors of industry, but what would this mean for the structurally so fragmented building sector? The ultimate test in quality related thinking is customer satisfaction, but as already stated, the actual customer, the end user, generally, takes no part in the Dutch building process, except the scarce homebuilding principal . Besides, designers, contractors, suppliers, and authorities have shared responsibilities: nobody feels accountable for the whole process. Although integrated contracts are becoming more popular -partly as a consequence of the need of integral accountability -they still only constitute a small part of the present market of construction and refurbishment.

With a coherent approach also methodical improvements can be implemented and monitored leading to a more consistent practice that, by means of reference, can become part of the same chain of knowledge.

ECONOMIC AND SOCIETAL RELEVANCE

Structured regulation has a key role in the translation of essential needs regarding the built environment. As we are all regular users of that built environment, whether it be living, working, recreating or travelling, that regulation is essential for our society.

However, everything has its price. When we look specifically at the development, learning, applying, enforcing and implementation of the rules and regulations – which we have symbolically represented with the two knowledge circles in figures 2 and 4 – then this refers to a process which involves thousands of specialists on a daily basis. There are no exact figures on this commitment of people and costs.

The construction, management and maintenance of real estate involves substantial amounts of money. Some expenses directly contribute to the quality of the built environment; other expenses are needed solely to apply regulations, so at the best they contribute indirectly to the safety, health and sustainability of buildings. The latter expenses ERB estimates for a big part unnecessary.

Moreover, costs arise when a design or existing work does not meet the regulation, because the applicant simply knows them insufficiently and the regulation is not enforced. At present, enforcement takes place mainly by means of random checks based building plans on paper. Enforcement should take place much more on the basis of buildings actually constructed, specifically with a view to the real risks for which this regulation has been written.

In the ERB study report it is demonstrated in a conservative estimation that by implementing the proposals every year more than € 1 billion can be saved on a turnover of € 20 billion. Other benefits will be;

- Better and more understandable building regulations;
- A very simplified process to get the environmental permit;
- Better environmental performance ;
- Less disputes;
- More satisfied people in relation to the quality of buildings.

THE STEPS TO TAKE

The ERB report 'After Dekker' describes actions to be taken to innovate the building regulations and the building assessment system. First of all the parties concerned have to sign a covenant that outlines their intentions, their duties and their rights. The Government has to provide starting capital to finance the creation of the independent Knowledge Institution and the first steps of the renewal of the system of building regulations (stating the objectives). Also the Government has to decide the necessary changes in the laws and the moment that the environmental permit system will no longer need the technical assessment of a building plan, but in stead owner and contractor will have to declare the performance at the occupation moment.

When those decisions will be taken all other improvements will follow as the logical outcome of the new structure. All parties involved can finance yearly the Institution from

their savings every year, estimated at least the € 1 billion predicted efficiency improvement.

At the moment the Parliament is in discussion with the Ministry about the future of the building regulations and the innovation that is needed. The reports of Actal, EIB and ERB are therefore starting point. The need is the higher because of the political discussion about the limited quality of Building Decree 2012.

6. ACTAL AND EIB-STUDIES

The Actal study is complete in line with the ideas of the ERB-study. The differences are that the ERB-study is comprehensive, both in regulation steps as in process steps, with an activity plan, time schedule and cost reduction estimation. The Actal study only does suggestions without further motivations and conclusions.

The predominantly monetary EIB study calculates costs and benefits of rules and regulation. They focus on rules and regulations that they define as unnecessary, because they are not cost effective. The study sees balconies and sheds as unnecessary: houses are cheaper without. The same applies to high standards for energy saving. The calculation of the savings of money is too high: it is not related to the effects in reality (e.g 10% less balconies, because the majority of houses still gets them) but takes the costs of all balconies because they are not longer an obligation. For other aspects they argue that the rules are not effective and thus unnecessary (the measurements of staircases). We think this is an argument for better regulation, not doing without. In total the study counts to 0,5 billion cheaper construction without these rules, which is only theoretical and highly overstated.

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A Risk Response Plan Framework for Housing Construction Project Delays in the UAE

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ABSTRACT

The risk response plan in delays control is a crucial process in risk construction project management. However, it has not yet been fully implemented in many construction companies in the United Arab Emirates (UAE). Furthermore, few studies provide evidence of its impact on control delay risks. That said, it is known as a guiding tool in decision-making to reduce conflicts and increase co-operation among the project stakeholders and to create the essential conditions for optimal risk identification and assessment to determine whether a risk has increased or decreased. This has encouraged construction companies to focus more on the development of strategies to avoid such delays through risk mitigation (reduction, avoidance, transfer, or absorption). Demonstrating a close-fit view with past and recent research as published in the literature, this paper discusses preventive and mitigating measures for risk response plan development from several options. A case study in a PPP construction company for housing development in the UAE was investigated. The risk responses used were risk reduction and risk absorption, applied due to the nature of the risk involved. To validate the preliminary results from the case study, structured interviews with engineers, project managers and managers in the contractor and consultant companies dedicated to the project were conducted. An adaptive management framework for developing risk response is then suggested on the basis of the outcomes from the case study and the analysis of the interviews.

Keywords: construction delay, delays risks control, project management, risk response plan, UAE.

INTRODUCTION

Most organizations attempt to manage their risks within the identification and assessment process. Such development has generally been considered to ensuring comprehensive identification and assessments of risks through project planning in the risk management (Cooper and Dale 2005) however, identification and assessment will be worthless in the risk management process unless risk response can be developed and defined.

As already mentioned, delays risks response planning in construction has not yet been fully addressed, but over the years, many studies have been undertaken in quite different environments, and have critically reviewed the issue of delays in order to determine the causal factors. From these studies, it is known that there are significant factors related to

the client and project managers (Ahmed, et al. 2003, Motaleb and Kishk 2011), the contractors (Dimitracopoulos 2008), and financial problems, possibly coinciding with the recessions arising in 2008-2009, such as poor cash flow, funding programme constraints, and payment delays, that are related to the economic situation (Sweis, et al. 2008, World Bank Iraq Trust Fund 2009). This situation is not peculiar to the UAE; indeed the effects of the financial crisis are shared by all countries (Motaleb and Kishk 2010, 2011). Consequently, it can be appreciated that the management of the outcomes from each category-related delay risk may require risk response development rather than the traditional management, and accordingly, there would be a need to make certain priorities in the risk response plan.

The objective of the research that underpins this paper is to outline a framework for appropriate risk response management in construction delays for construction companies in the UAE.

Risk Response Management

Having reviewed the literature relevant to risk management, it appears that risk response management is the most important stage in the process since this determines the ability of managers to enhance opportunities and reduce threats in projects. More specifically, the risk response plan has the potential to create the essential conditions for optimal risk identification and assessment that allow managers to determine whether a risk has changed in nature, increased or decreased.

Earlier research has encouraged the risk response through three channels: response by contracts, by retention, and by insurance (Zhi 1995). Some identified responses such as prevention, mitigation, transfer, retention or combination have been considered, particularly in the early stage of the project lifecycle (Thomson and Perry 1992). Detailed preventive measures and contingency plans should be provided by the project manager (Risk Management Guidelines 2003), and they are most valuable at the early stages (Thompson and Perry 1992). Furthermore, reduction, protection, contingency, acceptance, and transfer types (Risk Management Guidelines 2003) are all known to affect the overall strategy of the project, albeit in limited areas of risk (APM 2006). However, although both preventive and mitigation measures are useful, and indeed commonly used in the development of a risk response plan, the mitigation route is identified as the most expensive (Cooper and Dale 2005). Hence, it is advisable for clients to take responsibility for each agreed risk response (Burtonshow 2009), and deal effectively with risk severity for cost effective, time success, positive procurement, quality, and schedule plan outcomes (Sanghera 2010).

In the UAE, the impact associated with delays risks has been attributed to two factors, these being: 1) Limited research, and 2) Traditional management used by construction companies. However, the global financial crisis of 2008-9 was (and remains) a major delays risk, and little understanding has emerged as yet of the extent of the influence occasioned by the financial crisis, on the delays experienced in projects. At the same time, it can be said that few studies in construction management have concerned themselves with exploring how a more developed approach to project management,

rather than the traditional one, could be more valuable (Wysocki 2009). Certainly, it is reasonable to expect that all stakeholders in construction projects should possess sufficient knowledge to enable their effective participation in decision-making, yet their experience of contributing to risk management efforts is limited because of the emphasis on the traditional approach that excludes them. In particular, the quantified risks like change orders, on-time performance, would benefit from such inputs since the traditional project management approach omits these completely, and hence, does not consider the potential for change nor the way to deal with it. Additionally, the traditional management technique has failed to ensure that the most appropriate tools for evaluating the way to respond to risk are used. The adaptive project management cycle as envisioned by Taylor and colleagues (Taylor, et al. 1997), involves learning from experience to control uncertainties or risks, and assessing the relevant assumptions made in light of that experience (see Figure 1). Adaptive management has shown itself to offer a more successful framework for operation than traditional management, in several disciplines such as environmental management (Murray and Marmorek 2004), and recognises the value of the various stakeholders' knowledge in its decision-making (Lal, et al. 2001). Consequently, there is no reason why action levels should not be defined for risk response in construction to identify links between monitoring and adjustment to the responses. With the use of adaptive project management in construction, improved risk response outcomes can be obtained, and hence, improved productivity will follow.

In addition, the review of preventive and mitigating risk response measures, as discussed in the literature, supports the contention that both types of measure are important when considering project risk response development. On the basis of the outcomes from the survey in the case study in Abu Dhabi, and the interview analysis, a framework is suggested as shown in Figure 1.

Figure 1: Adaptive management cycle for construction project risk response (adapted from Taylor, et al., 1997)

RESEARCH METHODOLOGY

The research method involved a literature review which identified key factors relevant to risk response measures, and interviews with the stakeholders in the case study project.

Sixteen structured interviews were conducted with engineers, project managers and managers in the contractor and consultant companies identified in the case study. The structured interview approach may be used when more quantitative data is needed, in effect allowing for a survey of particular parties' attitudes (Yin 2003). The main advantages offered by interviewing include being able to obtain in-depth information on a wide range of issues, and the ability to develop a relationship with the interviewee that might be of use later to validate the study. The case study employs the SPSS to analyse and to help in the presentation of the data, which in itself contributes to the development of a framework for the case study.

The Case Study Project

As part of the development of the country, the Abu Dhabi Government is implementing various projects/programmes to enhance public living standards in the different regions of Abu Dhabi, the capital of the UAE. Housing development projects undertaken by the governmental general services company (MUSANADA) and Nael and Bin Harmal Hydro Export Est. (a prestigious contracting company with annual turnover more than $5 million and a contract value of $30 million) are the main objective. The work involved is the construction of 60 villas. In addition to the construction of these villas, the infrastructure is also to be provided, so activities such as site grading/leveling, sewage works, storm water works, potable water works, electrical work (including the building of a sub-station, and street lighting), road works (including road signs and road marking etc.) are all included within the scope of the work. Additionally, there is all the planning, procurement management, execution, and stakeholder management to be considered and effectively delivered.

Furthermore, because the client (the government) changed the specification for the rooms after securing more information concerning the size of the families who are expected to occupy these villas, all of the villas have had to be internally modified to enlarge the rooms, and this had to be done when more than 50% of the work on the villas had already been completed. After the client's approval, the relevant documents must be submitted to the appropriate authority for the building permit. The traditional risk management extract as presented in Table 1, indicates the consequences of the delay, the risk measures, and the potential risk response.

Table 1: The Traditional Risk Management Extract for Abu Samra Project

Consequence of the delay	**Risk measure**	**Risk response**
Construction of villas cannot start before obtaining the building permit	Client and Consultant should approach the relevant Authorities in order to expedite building permit sanction	Risk reduction
Construction of three villas can be started after obtaining the revised building permit	Client has to co-ordinate with the end user requirement before proceeding with the building permit	Risk reduction
All the constructed villas have to be modified as per the revised design after obtaining the revised building permit	It is a major risk	Risk absorption

RESULTS AND DISCUSSION

This section reports the results of the structured interviews conducted to understand the measures for risk response development according to the case study project. To improve the risk response, twenty-two preventive measures (in pre-construction) and fifteen mitigating measures (during construction) were identified from the literature with a 1-3 Likert Scale. The preferred measures as indicated by the interviewees are considered to be (1= least recommended, 2 = recommended and, 3 stands for highly recommended):

- In respect of the preventive measures (pre-construction), the top factors as identified by the interviewees (considered to be highly recommended) are: more anticipated risk identification (62.5%), and prepare a programme from previous experience observing the effect of the financial crisis (50%) while the factors considered to be recommended are: contingency plan development (62.5%), improve decision-making support system (62.3%), knowledge in product positioning and market success-technological development for market competition (56.3%), significance shared with stakeholders' effective communication (56.3%), high share impact risks with other stakeholders (risk owner) (56.3%), proper performance knowledge proper quantitative and qualitative risk analysis (56.3%), and prepare advance programme from past learnt projects under financial crisis effects (50%). In addition, developing knowledge base for planners, contract performance (50%), develop labour knowledge (50%), and proper risk management training (50%).
- In respect of the descriptive mitigating measures during construction, as shown in Tables 2 and 3, the interviewees indicated a new core for adaptive management using the reduction risk response type development as follows:

Table 2: Risk Response Development during Construction (highly recommended)

Mitigating measures (reduction)	**Frequency**	**Percent (highly recommended)**
Develop change management (in variations)	9	56.3%
Exchange of adequate incentives and rewards-between contractors and clients	9	56.3%
Use past lesson learnt	8	50%
Up-dating project schedule for any new identifying risk-avoidance	8	50%

Table 3: Risk Response Development during Construction (recommended)

Mitigating measures (reduction)	**Frequency**	**Percent (recommended)**
Manage the overlapping activities considering budget and schedule	11	73.3%
Delay re-analysis	10	62.5%
Proper plan for optimal risk allocation	9	56.3%
Increase project team productivity –resources (Expert manpower/efficient equipments/ technology)-risk buffering	9	56.3%
Improve Municipality inspections process for change requests	8	50%

- 62.5% are preferred to proceed into transfer risk response type, and 62.3% preferred to absorb the risks by new risks reviews and updating the risk plan under any new approval permit.
- 50% have agreed on the effect of the stakeholders on the project objectives (time, cost and quality) and 56.3% have strongly believed the project manager is the most important person in delays risks control. More specifically a trained project manager is preferred by 62.5% of respondents.

The quantitative approach was adopted to allow for an easy comparison to be made between the key issues identified from literature and the different dimensions identified in the data collected from the interviews (i.e. participants' experiences of the case study project, and their reflections on how changes and improvements could be achieved in the future).

Accordingly, the proposed framework for the project risk response plan adopts a cyclical form, representing a different approach from the traditional management strategy, thereby introducing adaptive management (see Figure 1). Such a change in management style will facilitate the achievement of the stipulated project goals (time, cost, quality) and more specifically, a reduction in time:

1- The suggested preventive and mitigating measures should be schematic and placed at the core of the company's new strategy which should take account of stakeholders' opinions and the new and iterative risks, like client change orders, which are frequent in the UAE. Hence, there should be a strong client focus.
2- The client and the project team/stakeholders should develop the preventive and mitigating measures scheme accordingly.
3- The client and the project team together should develop the design and budget for plan B (contingency) by passing through many iterations until they have met the client's defined goal, and only then should they move to the next stage (design risk response plan).
4- The design and budget should be revised at the 50% design stage when there is a possibility to change if necessary. During this stage the client and the stakeholders might encounter the need to make many changes (implement risk response plan).
5- The final development of the design (100%) should be a client-focused step to finalise the project parameters for client sign-off to proceed to the construction documents (monitor the risk response plan).
6- Similarly, the construction documents process (permits, new approval) should follow the same development as in numbers 4 and 5.
7- Finally, adjust the risk response plan accordingly.

As outlined above, there should be two groups of measures developed, the preventive measures in pre-construction and the mitigating measures during construction, and the risk manager should identify alternatives/contingency plans or options as a strategy to minimise delay risks. However, such alternatives should not imply that the business direction of the project changes. Rather, the idea is to be flexible in the

management style, effectively ensuring an adaptive management approach in which all stakeholders are involved.

CONCLUSION AND FURTHER WORK

Both the literature and findings from the case study supported the argument for risk response improvement in the performance of stakeholders and projects. The use of the adaptive framework can be perceived as valuable in bringing success to a project through its use of two measures that could improve the nature of project stakeholders' performance. The first set of measures are those described as preventive and should be introduced in the pre-construction stage as a result of more concentration on risk identification, contingency planning, improving the decision-making support system, knowledge, etc. The second set of measures are those described as mitigating measures, and these involve the development of change management (variations), exchange of adequate incentives and rewards (between contractors and clients), building on the knowledge gained from previous experience, etc.

This study has identified a number of interesting aspects in the risk response management of construction delays in the UAE. The development of a response to risk is essential in order to control delays risks. The research work has shown that both the literature and the findings of the case study call for risk response development in an effort to making improvements to traditional management approaches by the introduction of adaptive management, which would have as its core, preventive and mitigating measures development. A framework has been developed in seven steps considering both stages (design and documents at 50% and 100% stages) to identify and finalise client goals and the method of stakeholder management. Accordingly, risk response would be adjusted.

The limitation of the current study is the single case study approach. There was a need to investigate further how project 'success' is achieved, particularly in relation to developing risk response strategies in construction companies in the UAE for the following areas: (1) Stakeholders and risk management (eg. decision-making support, skills development and training, etc.); (2) The construction process (eg. developing risk response measures in the pre- and during construction stages).

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BEST VALUE SYSTEM DOCUMENTS PERFORMANCE OF CITY'S PUBLIC WORKS DEPARTMENT PROJECTS

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ABSTRACT

The risk of deviations on construction projects has been high. However, without a methodology to identify the sources of project cost and time deviations, construction deviations have been a necessary part of the project. The City of Rochester recently adopted the best value PIPS approach to minimizing project risk. It has minimized the need for client project management and also changed the paradigm of delivering the project. It has identified a major source of project deviation as the client and their design representative. It has also shown the need for the participants to use a different paradigm of being proactive instead of reactive.

Keywords: risk minimization, best value education, mediation, performance information, decision making.

INTRODUCTION

Construction risk can be defined as project cost and time deviations (Kashiwagi, 2012). Delays, cost overruns, and misalignment of expectations can be common in construction, and especially complex projects (Heijmans & Hyland, 2012; Bosch-Rekveldt, M. *et al.*, 2010). Larger more complex projects which have more participants have a greater potential for risk, but all projects seem to have the risk of time and cost deviations (Benta, 2011).

This paper documents the City of Rochester's (Minnesota, United States) approach to implement a proactive risk management system that increases transparency of all parties. The paper begins with a brief literature review to help define "risk", current risk management practices in construction, and a review of best value (BV) procurement processes. The paper also discusses modification of the best value selection criteria, and concludes with a discussion of the system's impact on the delivery of services at the City.

There are two primary objectives of this paper:

- Document a methodology that reduces decision making and need for technical expertise during selection

- Explain the implementation of a best value approach to manage projects and resolve issues

Literature Review

The traditional low-bid procurement system is riffed with problems: it can attract companies "hungry" for work that use change orders during the project to make up the cost (Winston, 1999); there is a lack of expertise in the environment (Angelo, 2003); higher number of claims, schedule delays, and public safety issues (ENR, 2001); and a potential lack of money to successfully complete the project (Anonymous, 1998). The alternative to "low-bid" is "best value", where the owner considers multiple factors during selection: technical capabilities, financial viability, past performance, and of course, price (Gransberg, 1996). One such best value system is the Performance Information Procurement System (PIPS) (Kashiwagi, 2012).

"Risk," in a general business sense, is an event that somehow affects a company's finances, and risk management is the process by which companies eliminate such events, or minimize their impact (Kraman & Hamm, 1999). Risk, as considered in the construction industry, is anything that increases project schedule or cost, or decreases customer satisfaction (Kashiwagi, 2002). Therefore, logic follows that in order for construction personnel to perceive the existence of risk, they must measure their projects (Cotts, 2010). Cotts suggests that the only way for personnel to actually improve their ability to meet customers' objectives is by consistently measuring their performance over time.

Simply identifying the presence of, or potential for, risk does not necessarily mitigate it. Some literature suggests that the accountability and control of actually minimizing the risk should be left to the expert (Kashiwagi, 2012; Sullivan & Guo, 2009). In fact, this literature suggests the following approach to risk management:

1. Before awarding a contract, the owner, or their representative, asks the expert to identify their overall plan to successfully complete the project.
2. Within this plan, the expert should clearly explain anything that could stop the project from being completed in accordance with their baseline expectations (in terms of cost, schedule, or customer satisfaction).
3. Once the contract is signed, the expert should document the sources of any deviation to the baseline expectations.

PROBLEM

The risk of deviation on construction projects is high and the management of the risk has become a necessary part of managing the construction project risk. As a result, miscommunication, lack of accountability, cost and schedule deviation, and owner dissatisfaction become a regular part of an owner's projects. Therefore, the problem is that owners do not have a structured selection system that minimizes biased decision

making, and project management methodology that clearly monitors performance in terms of deviation from the baseline expectation.

HYPOTHESIS

The authors' hypotheses for this paper are as follows:

1. A structured selection approach will help the city obtain the best value for the lowest cost
2. The PIPS best value system clearly documents deviations and assigns accountability to the appropriate party
3. The overall best value system helps participants be more proactive in resolving issues before they become cost or schedule deviations

METHODOLOGY

The authors used the following methodology to test the hypotheses:

1. Pilot the PIPS best value selection process on several construction and professional services projects at the City of Rochester
2. Implement a risk management and documentation system that shows the source of risk
3. Monitor the results in terms of performance over time

IMPACT OF THE BEST VALUE SYSTEM

The City of Rochester has used the PIPS Best Value process since December 2009. In that time, they have used it on four phases of the new Public Works Transit Operations Center (PWTOC), the Rochester National Volleyball Center (RNVC), and the Lenwood Height Neighborhood sanitary sewer and water main upgrade project. Additionally, the City piloted the PIPS selection methodology for the evaluation of the 2nd Street SE Reconstruction's (2SE) Statement of Qualifications. This project was part of the Minnesota Department of Transportation's (MnDOT) design-build pilot program. The City publicly released the budget for each project as part of the Request for Proposals (RFP) documents.

Best Value Consideration of Price and Lowest Bid

Table 1 below shows the project budget, best value awarded contractor's base cost, average proposal base cost, and the lowest proposed cost for each pilot project. Note that the proposals for 2nd Street SE Upgrade and Lenwood Heights projects have not yet been received as of the time of this writing; thus, the cost information for these two projects is not available.

Overall, the best value proposers' cost is 20 percent less than the budget, and 3 percent less than the average proposal cost (we have seen similar outcomes on numerous other best value PIPS projects). These results are important for two reasons. First, the large differential between the best value proposal cost and the budget suggests that giving the budget as part of the proposal does not encourage vendors to arbitrarily increase their costs to be equal to, or slightly less than, the budget. The nature of construction procurements, even in best value environments, ensures that proposals are price competitive. Secondly, the best value proposals are generally more price competitive as compared to the average cost proposal. Owners have occasionally expressed concern that under PIPS, the awarded contractors will have a higher cost; however, the results of these projects should help to alleviate this concern.

Table 2 – Best Value Proposer Cost Comparisons

No	Cost	PWTOC –2	PWTOC – 3	RNVC	PWTOC – 4	PWTOC – 5	Overall
1	Total Budget	28.50	0.40	3.40	1.84	7.80	41.94
2	Best Value Proposal's Base Cost	21.50	0.37	2.75	1.79	6.96	33.37
3	Average Proposal Base Cost	22.10	0.31	2.85	1.89	7.13	34.28
4	Lowest Proposed Base Cost	21.24	0.25	2.75	1.79	4.77	30.80
5	% BV Cost +/- Budget	-25%	-8%	-19%	-3%	-11%	-20%
6	% BV Cost +/- Average Cost	-3%	17%	-4%	-6%	-2%	-3%

Contractors in the Low Price Paradigm

The PIPS evaluation criteria were modified, beginning with the Rochester National Volleyball Center project, in an effort to encourage respondents to identify their technical and risk-minimization capability in terms of metrics. The primary updates to the process were as follows:

1. Separation of the RAVA plan into two distinct, and separately rated, components: Risk Plan and Value Add Plan. Risk Plan should only address events or conditions that could stop the project from being successful. Value Add Plan should increase owner satisfaction, and/or improve performance, and must have a cost impact.
2. Addition of the Project Capability document, which allows the proposers to specifically address their unique abilities to meet the needs and requirements of the owner.
3. Claims must be supported with simple logic and performance metrics in order to receive a "high" rating from the evaluation committee.
4. Change the Pre-Award Kickoff Meeting from an educational session for all participants to one where the potential best value contractor presents their draft Risk Management Plan, Milestone Schedule, and Cost Proposal.

These changes have resulted in 67 percent more claims and risks being supported with documented performance. However, this is likely a result of the proposers providing what was asked for. The percent difference of the standard deviation of the interview ratings between the best value proposer and the other interviewees increased 112%, due to a lower standard deviation of committee interview ratings of the best value proposer. In other words, the best value proposer is becoming more dominant in the interviews, as evidenced a higher level of consensus in the interview ratings. Finally, with the exception of PWTOC – 5, there is an overall increase of the best value firm being ranked first in the evaluation criteria.

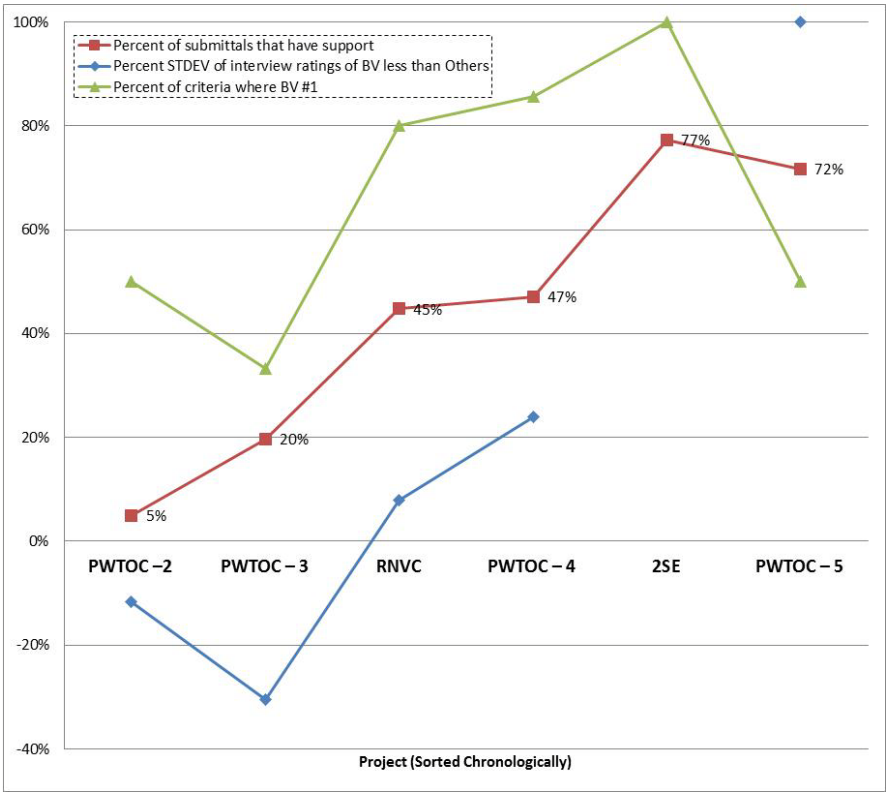

Figure 1. Impact of PIPS Best Value System Changes.

Owner's Gradual Learning of the System

Technical review vs. non-technical review

The aforementioned changes in the system were designed to minimize the impact of evaluator bias and the need for technical expertise in identifying a high performer. The proposers were instructed that their submittals need to address risk they do not control in the following manner: what is the risk, how they will minimize the risk, and how they know their solution is accurate (as evidenced by the inclusion of past performance information to justify their claims). Evaluator decision making (or guessing) on the merits of a proposals is reduced due to the inclusion of performance metrics.

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Methodology in resolving issues

One of the key components of PIPS best value system is the approach in resolving misunderstandings, problems, and unmet expectations. The methodology is as follows:

- Upon identification of an issue, the expert (awarded contractor) should identify a potential solution with cost and schedule impacts, and then notify the owner. The expert should identify a date by which the owner needs to respond.
- The issue should be immediately documented on the Weekly Risk Report, including a description of the risk, a solution, a plan to resolve the issue, who's responsible for the issue, and the cost and schedule impact
- The Risk Management Plan should be updated to reflect any changes in the expert's plan to minimize other risk in the future
- Once the owner confirms acceptance of the plan, the expert will implement the solution. If a response is not received by the due date, the expert to document the delays on the Weekly Risk Report.
- Each week, the owner rates their satisfaction with the expert and their implementation of the plan. This weekly rating is in place simply to increase transparency between the expert and the owner.

Definition of risk and financial responsibility

The final section of this paper reviews five issues that demonstrate the planning component of the best value system.

1. Wind exposure category change ($24,156)

   During the shop drawing review stage, the designer increased the wind exposure rating on a cold storage building to Category C (resistant to stronger winds) from Category B. The subcontractor's updated design required additional material. Thus, the general contractor requested a change order amount of $24,156 to cover the redesign fees and additional structural material.

   Initially, the owner felt that the contractor should have assumed a wind rating of Category C, and included it as part of the initial base proposal. The reasoning was that, while the initial design reflected Category B, the contractor should have known the building would not be acceptable the lower category. The contractor identified that they proceeded with the work without an approved change order to keep the project on schedule. Ultimately, the owner agreed to pay the change order after understanding that while the contractor should have identified upfront the issue, they cannot be financially liable for design errors.

2. Quantity of AIM modules ($20,000)

The project required the installation of Automotive Information Modules (AIMs) in the Fuel Management System. The specifications did not indicate the quantity of AIMs needed, so the subcontractor provided 20 (upon clarification, the designer stated 85 AIMs were required). The owner assumed that the contractors would provide enough to meet the intent of the project (one for "each" vehicle). The contractor proceeded with installation of 65 additional AIMs, with the assumption that the City would approve the additional costs. The City agreed to pay the additional costs.

3. Modification to center parking lot island soil ($9,853)

   The facility has a large center vegetative island in the main parking lot. The drawings provided conflicting information so the contractor assumed the worst case (most expensive) scenario, and made the area into a bioretention basin to match the surrounding islands. Once the site was constructed, the landscape architect identified that is was to be a planting bed, and the City directed the contractor remove the bioretention material, and replace with onsite top soil (at a cost of $9,853). During a mediation session, the architect identified that the contractor should have known top soil was meant to be used "based on the type of grass seeding." The City readily agreed to approve the change order once the entire timeline of events was clearly laid out to all parties.

4. Transverse bars in footing ($12,597)

   While in the process of pouring footings, it was discovered that the structural engineer wanted transverse reinforcement (rebar). The footing schedule did not indicate the need for transverse reinforcement in these footings. The Owner's inspector approved the footing construction up until that time and believed that transverse reinforcement was not required. Upon notification of the requirement, the contractor developed a corrective plan which salvaged some of the footings and adjusted the schedule to accommodate the delivery and placement of the precast panels. The architect identified that a detail indicated the need for transverse reinforcement, although it was a typical (non-dimensioned) detail.

5. Heat pump relocations and modifications ($0)

   The mechanical subcontractor installed numerous heat pumps as identified in the drawings. However, field locations of the pumps were such that they were not accessible for repair and maintenance and the subcontractor had to reinstall per the City's code officials. The contractor requested $16,834 for the additional rework, but the City denied this claim. Field coordination is the responsibility of the experts. If they had identified the risk upfront, the entire issue could have been mitigated before it even occurred.

While the total cost of these particular issues was 0.3 percent ($66,606) of the awarded contract, they have caused a tremendous amount of transaction and stress from all parties.

SUMMARY AND CONCLUSIONS

The City of Rochester has taken a proactive approach to identify construction experts, and has experienced a high level of performance, despite struggles faced in learning a new project management paradigm. In summary, the paper has identified:

- A proactive, risk-minimization approach to construction projects reduces confusion
- An approach use dates, and a simple explanation of events, will minimize transactions, and increase overall satisfaction of all participants
- A major source of deviations is from the owner and their design representative
- There is a need for all construction participants to adopt a proactive paradigm, instead of a reactive paradigm

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DEFINITION OF SPATIAL TEMPORAL MEASURES

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ABSTRACT

With the advancements and the up rise of the construction market, contractors are forced to deliver larger scale projects in shorter durations. In order to do so, more concurrent activities are scheduled and more crews are needed, which increases the risks of workspace conflicts on sites, eventually affecting the productivity and cost. Thus, there is an increasing attention to identify measures that are able to detect and analyze the possible workspace conflicts that would occur in a project before execution. Currently, practioners perform workspace analysis via expert judgment; however predicting the interference between workspaces is difficult due to the huge number of elements and activities in a project. This paper identifies new measures called "Spatial Temporal Measures" which are measures associated with space and time. It presents the proposed calculation to measure the different workspace conflicts' degree in projects. A sample model was developed to show the calculation of one of the measures: "Worker density per overlapped workspace (WDO)". The paper also presents a case study, where a developed software tool measures the workspace conflicts and minimizes them in the masonry activity from eighty five percent to fifty percent in a residential project.

Keywords: Productivity, Spatial Temporal Measures, Worker Interference, Workspace Analysis

INTRODUCTION

With the growth of the construction industry, projects are getting more complex. Alongside, contractors are being expected to deliver with the highest quality in the shortest period, to be able to survive in this competitive market. This means that contractors need to schedule as much concurrent activities as they can, while maintaining tight control on the workers to insure the quality. One of the problems with contractors

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executing a huge number of concurrent activities is the appearance of workspace conflicts. Workspace analysis has grabbed the attention of many researchers in the construction industry (Mallasi 2006; Thabet and Beliveau 1994; Sirajuddin 1991). Currently, most practioners analyze workspaces via their technical background and judgment, which requires time and effort and in large scale projects is impossible to process all the data. However, very few researchers have utilized the benefits of the BIM technology and the four dimensional schedules for the analysis of the workspace. Many studies have been introduced where BIM Technology has helped in predicting and forecasting most engineering aspects (Popov, et al. 2010). This study aims to create a framework, identifying new sets of measures called "Spatial Temporal Measures" which are the measures associated with the workspace needed for an element at a certain period of time. The study also investigates the possible actions that could be taken while planning to reduce the workspace conflicts on site. Results of this study would develop a better detailed visualization of the project's execution plan that would help contractors achieve project objectives (finishing the project on time and within budget).

LITERATURE REVIEW

In this section, four main issues will be addressed: What is a workspace? Why do workspace conflicts occur? What is the danger of workspace conflicts on the project cost and duration? How researchers model workspace in a project?

Dealing with the first issue, workspace is basically the surrounding volume around any element that workers would need in order to be able to execute any activities assigned to them. Many researchers (Thabet and Beliveau 1994; Sirajuddin 1991) suggested that any workspace is the arrangement of the crews, their equipment and tools and suitable maneuvering area. Sirajuddin (1991) explained that many planners could conclude the workspace requirements from their previous experience mainly, or could use data as equipment manuals to attain such information. He also added that the workspace arrangement could be concluded from some basic calculations applied to the method statement of the activities. Hence, the main source of information for planners would be their own expert knowledge, and would sometimes utilize the knowledge of other site engineers in complex activities.

However, usually planners don't convey their knowledge properly to the engineers, regarding the workspace arrangements (Cheng and O'Connor 1996). The reason is that most of the current planning techniques involved either hand sketches or 2D diagrams as which are not sufficient to reflect the 3D properties of the workspace (Kamat and Martinez 2001; Morris 1997; Woodward 1975). Many Researchers stated that planners consider the Gantt chart as a favorable technique to reflect project plans, which only reflects what to be done, but not how, hence is not considered as the optimum communication medium (Mallasi 2006; Mawdesley et al 1997). Thus, leaving the workmen on site decide the execution of an activity, which then results in workspace conflicts (Mallasi and Dawood 2001). Consequently, it is safe to conclude that with the increase in number of activities, the project would witness the increase in workspace conflicts.

Moving to the second question raised, whether these workspace interruptions, or sometimes referred to as conflicts, have any effect on the project or not, a question that has been answered by many researchers (Howell and Ballard 1997; Muehlhausen 1991). For example, Riley and Sanvido (1997) while observing four trades for a period of two months in a project reported 71 cases of space-time conflicts. In another case study performed on a 6 million Euro project, evidence indicated that up to 30% of productivity loss was due to the lack of detailed space planning (Mallasi and Dawood 2001). Kaming et al (1998) also presented evidence that the productivity loss due to worker interferences was the highest among eleven other reasons. Their findings were concluded via a structured questionnaire answered by 31 projects managers from 16 different contractors.

Moving to the last part of the literature review, it was found that many researchers focused their attention to develop methods modeling the workspace in projects (Guo 2002; Akinci, et al 1998). Most research modeled three main parts: workspace, equipment space and path space. Researchers would create a database containing a variety of method statements, equipment manuals and codes that would then be able to compute the workspace of an activity automatically. Human input would be required in determining the sequence and the direction of the execution plan. Thus, this data would enable computing the workspace requirements per a given period. Most of the frameworks modeled the workspace as a surrounding space around the element depending on the nature of the activity executed. This paper will focus on the visualization approach called "Approximation Envelope (AE)" that was used by Mallasi (2006) in his research. As shown below in figure 1, the AE forms a virtual 3D box around the element, showing the above, below and surrounding space required. This method has helped research efforts a lot, since practioners could easily explain and detail the workspace of any element using this method. However a question still remains whether the 3D box is the optimum representation for irregular structures, but for certain project types as the residential projects, this concern could be neglected.

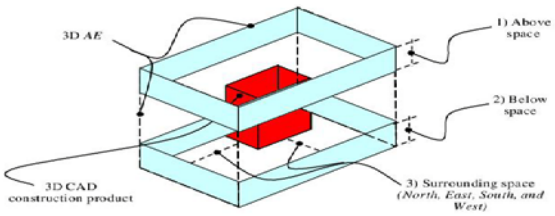

Figure 1 The AE method (Mallasi 2006)

RESEARCH OBJECTIVE

The objective of this research is to identify the spatial temporal measures and develop a calculation method to estimate the degree of each of these measures. Then, to explore what possible actions could be taken to optimize those measures.

METHODOLOGY

The effect of workspace conflict on productivity observed in the literature review varied from one case to the other due to many factors such as: the degree of work space interference, which is a ratio between the workspace affected and total available workspace; the duration of the interference, whether it was for one day or a full week; the nature of the activities being executed; and the nature of the conflict. For example, a workspace conflict occurring due to worker interference differs from a workspace conflict occurring due to an obstruction on site. Similarly, a workspace conflict occurring at a site boundary would have a different effect. Also, it could be deducted that workspace conflicts don't affect the productivity only, but in some cases could affect the quality, and even could violate certain safety measures. However, the goal of this paper is only to identify the different measures and propose ways to minimize them, as it was obvious enough from previous literature that conflicts harm the different projects aspects (Howell and Ballard 1997; Muehlhausen 1991; Riley and Sanvido 1997).

As explained above, workspace is suggested to be the combination of the crews and their equipment and a suitable maneuvering space (Sirajuddin 1991), and by using Mallasi's (2006) AE method, practioners are able to input the workspace required for an element by writing down the protrusion from each face of the element being constructed. This research assumes a uniform rate for execution of an activity, thus assuming a fixed workspace required per day. The other piece of information relevant to be able to model the workspace is the planned direction of execution of the activity. The element is segmented into smaller parts in the direction of construction, maintaining the dimensions in the other direction. For example, if a wall is to be constructed with the dimensions 3 x 0.25 x 3 meters in the X, Y and Z directions respectively in three days, and the X is the direction of construction; then the wall would be segmented into three segments with dimensions of 1 x 0.25 x 3 meters in the X, Y and Z direction respectively, each executed daily. The workspace would be segmented accordingly, based on the dimensions given by practioners. The direction of the construction in addition to the dimensions of the workspace would provide the spatial temporal properties needed for analysis.

After studying the literature well enough, brainstorming with experts in the field were conducted, with the goal of knowing what are the different workspace conflicts and how could they be measures. This paper shows the new measures that are categorized mainly according to the nature of the conflict occurring on site. Here, the types are explained in terms closest to the engineer's daily work to be able to relate to. Listed in Table 1 below are the measures: they have been categorized into three main categories: Crowding measures, Safety measures, and Site boundary measures. There are currently attempts to cover other areas in the project, however the results are still not certain and will not be presented in this paper.

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Table 1 Suggested Measures and Description

Measure Name	Abbr.	Description
Crowding Measures		
Worker density per activity workspace	WDA	Due to poor resource allocation, the number of crews for the job require a larger workspace than planed
Worker density per overlapped workspace	WDO	Due to the increased number of concurrent activities, crews require the same workspace ate the same instances
Safety Measures		
Safety Zones around equipment	SME	For example, around any crane there are certain areas that work is prohibited in it.
Space Requirement at Building Edges	SRE	The sufficient availability of space for crews to perform the work at higher floor
Site Obstructions		
Work Sequencing Measures	WSM	For example, the early construction of foundations in certain zones could affect the site access
Existing Obstructions	EXO	The effect of any existing obstruction on the progress of the activities

Through the brainstorming sessions, it was suggested that the conflicts should be measured in ratio with the planned workspace per day. Then, a duration factor is added to the model to account for the length of the conflict. Listed below in Table 2 are the equations used to estimate the measures

Table 2 Suggested Equations

Msre.	Equation
Crowding Measures	
WDA	
WDO	
Safety Measures	
SME	
SRE	
Site Obstructions	
WSM	
EXO	

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SAMPLE MEASURE

A sample 4D model was created to show the possible behaviour of the WDO measure in a project. The objective was to construct the walls with the following dimensions as shown below in figure three. The duration of construction was five days for all the activities. All the walls have the same width and height of thirty centimetres and three meters respectively.

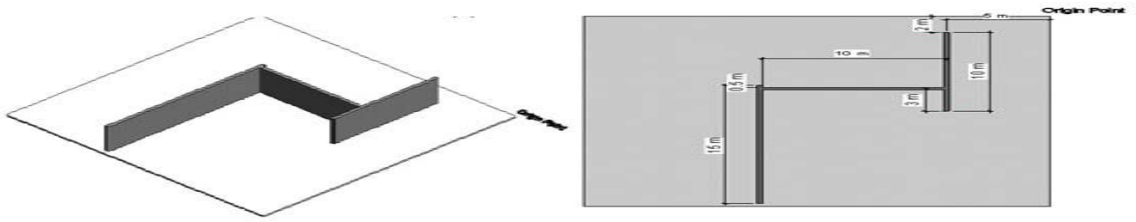

Figure 2 Trial Model and Dimensions

As explained above, data about the workspace dimensions and the direction of construction were inputted to the problem to be able to estimate the measures. The workspace was assumed to be one meter in width and maintaining the same length and height for each wall. Two different scenarios were run and the WDO measure was calculated each time. Figure 4 below shows the data for both scenarios:

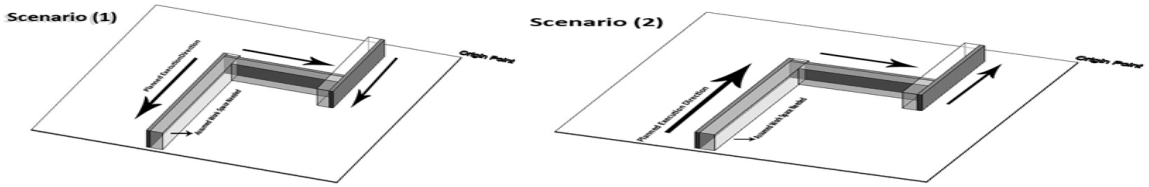

Figure 3 Different Scenarios

Assuming a uniform daily rate, then the progress of the activities for scenario 1 would look as follows:

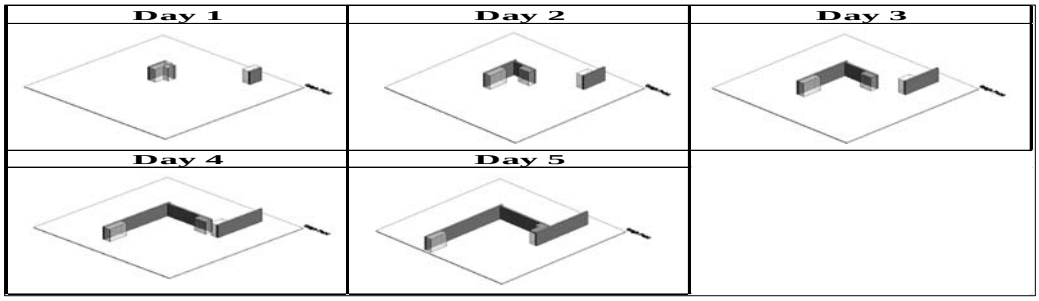

Figure 4 Activities Progress in Scenario 1

Using the equation designated for the WDO measure, it was found that this conflict occurred twice in the first scenario, in day one between Wall 1 and Wall 2, and in day 5 between Wall 2 & Wall 3. The planned workspace volume for Wall 1, Wall 2 and Wall 3 per day was 11.7, 7.8 and 7.8 m^3 respectively. The intersected volume in Day 1 was 7.02 m^3 resulting in the WDO measure of 60% in Wall 1 activities and 90% of Wall 2 activities. Similarly, in Day 5 the WDO measure for Wall 2 and 3 activities was 65%.

OPTIMIZATION OF THE MEASURES

There are many approaches that could change the value of the measures. The first basic approach would be changing the direction of the construction. Another approach could be changing the rate of execution instead from a uniform rate to minimize the works in areas with expected high values of the measures. Also, the workspace dimensions could change according to the modified method statement or resource allocation planned. For example, in the model above when the direction of construction changed as shown for scenario two in figure three, the WDO measure was minimized to zero. The daily progress is shown in figure 5.

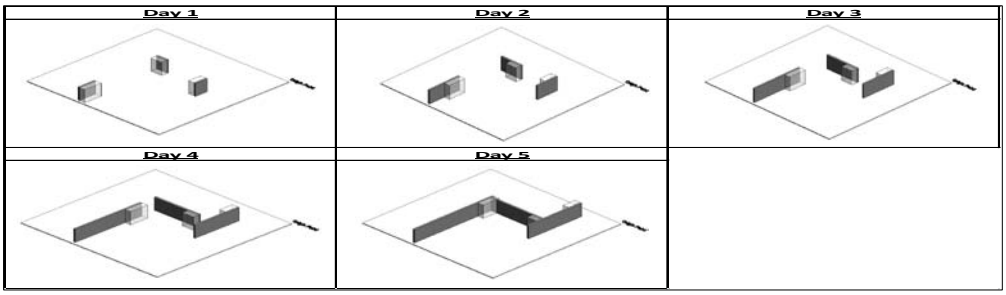

Figure 5 Activities Progress in Scenario 2

TOOL DEVELOPMENT AND CASE STUDY

As easy as the above model could look, in real case projects, the number of elements and activities being executed are multiplied and it becomes impossible to track the measures via simple calculations. Thus, a computer software tool was developed, that would read the geometrical and schedule data from the 4D model, then asks the user for the dimension of the workspace and the direction of the construction of each activity. A case study was applied to a model villa consisting of a basement, ground floor, 2 stories and a roof as shown in figure 6. Currently the software is programmed to decrease the maximum value of the workspace conflicts per activity via genetic algorithms, according to the users comfort. The optimization results of the model successfully decreased the maximum of the masonry activities from 85% to 50%. The optimization was done by only changing the direction of construction. Future work would be extending the software abilities to optimize more than once activity per run, and consider other factors as the workspace size and location and the number of crews are being studied to serve the optimization purposes.

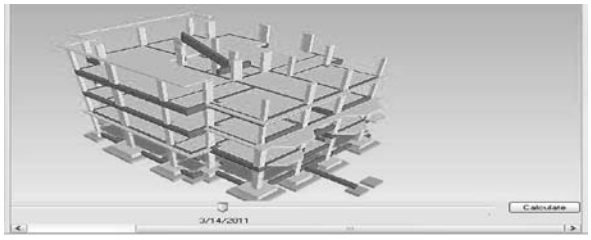

Figure 6 Mock up Villa model

CONCLUSION

This paper suggested a new set of spatial temporal measures with a new calculation approach. The measures don't only cover productivity, but also may help in safety measures, and in the future measures for other aspects as quality could be developed. The software tool developed utilizes the BIM technology and showed promising results regarding the optimization of the workspace results.

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INFLUENCE OF DESIGN ERRORS ON CONSTRUCTION PROJECTS' PERFORMANCE IN NIGERIA

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ABSTRACT

In the effort to improve construction projects' performance in Nigeria, this study evaluates the influence of design errors on construction projects' performance. The objectives are to determine the stage when errors were detected, compare the level of errors recorded in design documents and determine the influence of the errors on projects outcome. To achieve the objectives, eight project documents prepared during design were selected. A questionnaire survey approach involving a field survey of a sample of 164 projects was adopted. Data were collected using structured questionnaires and analysed using mean, ANOVA and Spearman correlation test. The result reveals that architectural drawings, bill of quantities and project specifications rank highest in design errors. It also reveals that design errors are majorly detected when the activities concerned are to be executed and the errors have significant influence on project outcome. It is concluded that design errors are common features of project documents and that the errors are detected too late and they impact negatively on project performance. Carrying out buildability analysis at design and tendering stages to detect and correct design errors early is suggested as a measure of minimising design errors and improving project performance.

Keywords: Construction projects, design errors, Nigeria, project documents, project performance.

INTRODUCTION

The poor performance of the construction industry in terms of the inability to deliver projects on time, at estimated cost and to required quality standards has remained a major concern to stakeholders in the industry. One of the causes of the problem is inadequate design and documentation of projects. Syam (1995) and Tilley and Barton (1997) maintained that the quality of design and documentation of projects have long been identified as major contributing factors to the inefficiency and poor performance of the construction industry. Tilley (2005) observed that project documents supplied to contractors are substandard or deficient due to incomplete, conflicting and erroneous information. Barret and Barret (2004) discovered that projects that run overtime and overshoot budget are often underpinned by faulty documentation that does not properly specify or describe the built solution while Egan (2002) observed that the perception of what constitutes good project documentation is declining. This study attempts to investigate the influence of design errors on project performance in the Nigerian construction industry. The objectives are to determine the stage when errors were detected, compare the level of errors

recorded in design documents and determine the influence of the errors on projects outcome. The results of the study are expected to reveal the impact of design errors and assist project stakeholders to embark on measures that will minimise design errors.

DESIGN ERROR AND PROJECT PERFORMANCE

Several issues are considered in research studies as design errors. In a study of project stakeholders' perception of design errors in the construction industry, Surther (1998) opined that design incorporates a set of specifications to guide a contractor in developing his means and methods in construction. He described design errors as deviation from drawings or specifications which includes mistake, omission and ambiguity. Davies and Ledbetter (1987) identified three basic types of errors namely: imperfections, non-conformance and omissions. The duo described imperfection as a deviation which does not affect the use or performance of a product, process or service. They consider non-conformance errors as those that do not meet specifications and thus require corrective action and omission as any part of a system that has been left out resulting in a departure from established requirements. In a report of the responses of clients, consultants and contractors to the definition of design errors, Surther (1998) identified errors or omissions and ambiguities in project documents, conflicting design information, incorrect information, misinterpretations of the owner's requirements, inconsistencies in plans and specifications that are foreseeable and require corrections as some of the issues regarded as design errors. The report shows that the issues that constitute design errors are inexhaustible however, the two major features of such issues are that designers should be able to foresee them and they should require correction when detected. In other words, issues that requires designers to provide new or additional information or design to what exists in project documents constitute a design errors.

Several studies have been conducted on the problem of design errors and their influence on project performance. Davies and Ledbetter (1987) maintained that major design quality problems occur during construction when errors, omissions and ambiguities in project documents become evident. The point in this assertion is that the effect of design errors manifest in several ways during construction when design documents are being implemented. This is perhaps the reason why Davies and Ledbetter (1987) asserted that the accuracy of design documents was the most critical of the criteria used in initial evaluation of design effectiveness. Chalabi *et al.* (1987) claimed that the quality of planning and design is one of the primary factors of success in any project endeavour. Kirby *et al.,* (1988), Lutz *et al.,* (1990) and Burati *et al.,* (1992) agreed with the assertion by maintaining that the quality of design and documentation produced has a major influence on the overall performance and efficiency of construction projects. The various ways by which design errors affect the performance of projects have also been the focus of many studies. Tilley and Barton (1997), Love and Li (2000), Tilley and McFallan (2000), Tilley *et al.,* (2002), Andi and Minato (2003) and Love and Edwards (2004) in separate studies discovered that inadequate and deficient design and documentation impact directly on the efficiency of the construction process by leading to delays, rework and variations which in turn contribute to increases in project time and cost. Tilley (2005) observed that poor design and documentation quality standards have often been identified as major contributors to projects running over budget, overtime, rework, variations and disputation. Hibberd (1980) discovered that 60% of variations were directly design and documentation related. Love *et al.,* (1997) found that a large proportion of rework and non-conformance costs are due to deficiencies in design and documentation and in the transfer of information during the design process.

There seems to be an agreement in the findings of the studies reviewed above that design errors are directly responsible for rework and variations which in turn contribute to the final delivery time and cost of projects. In other words, the effect of design errors manifests in the form of time and cost overruns in projects. These two parameters namely: time-overrun and cost-overrun can be regarded as the most prominent parameters of project performance. Hatush and Skitmore (1997) maintained that success in a project is generally operationalized into time, cost and quality. Michell *et al.* (2007) opined that the primary concern of construction clients is that their projects are completed within budget, on time and at the required level of quality. They further stated that timely completion of construction projects is frequently seen as a major criterion of project success by clients, contractors and consultants alike while cost-overruns are identified by them as one of the principal factors that lead to the high cost of construction. Quality which is also a prominent parameter of project performance is not a common project performance parameter in research studies because as Vincent and Joel (1995) put it: stakeholders see the goal of quality management as customer satisfaction.

RESEARCH METHODS

The study adopted a survey design approach that involved a survey of 164 building projects to achieve its objectives. To obtain the study sample, a preliminary survey of recently completed building projects in Nigeria was conducted in 2009 because reliable data of such projects was not available. From the survey, a list of 216 projects was prepared and adopted as the study population. From the population, 164 building projects were selected by random sampling as the study sample while the project leaders who were project managers, architects and civil engineers served as respondents.

The variables used for the study are classified into two, namely: project documents and performance. Eight documents were selected for the purpose of evaluating design errors. The documents are architectural, structural, electrical and mechanical drawings, bill of quantities, project specifications, Occupational Health and Safety (OHS) and quality management plans. Two parameters of project performance namely: time and cost overruns which are regarded in research studies as the most prominent parameters of project performance were used in the study. Data were collected on the characteristics, the initial and final contract periods and sums of the projects and the number of errors recorded in the eight project documents selected. Seven project characteristics stated in Table 1 were investigated. Respondents were requested to indicate the sub-variable of each characteristic applicable to their projects. The data were collected in the five geo-political zones in Nigeria in late 2009. The data were collected with the aid of structured questionnaires which were administered through personal visits to the respondents.

Two hypotheses were postulated in the attempt to compare design errors in project documents and their relationship with project performance. The first hypothesis states that the levels of design errors in selected project documents are not significantly different. The test of this hypothesis will reveal whether or not the problem of errors in project documents differ from one project document to another. The second hypothesis states that the levels of design errors in project documents have no significant relationship with project performance. The results of the test of this hypothesis will reveal whether or not design errors contribute to the performance of projects. The characteristics of the respondents and the level of errors in the selected project documents were analysed using percentage and mean while the research hypotheses were tested using analysis of variance and Spearman correlation test.

RESULTS

The results of the analysis of data collected are presented as follows:

Characteristics of Projects Sampled

The characteristics of the building projects sampled were analysed and presented in Table 1.

Table 1 Descriptive characteristics of building projects used for the study

Characteristic	N	%	Characteristic	N	%	Characteristic	N	%
Client type			**Procurement type**			**Project cost**		
Private	136	82.9	Direct labour	64	39.0	₦ 1-25 million	32	27.6
Public	28	17.1	Traditional contract	42	25.6	₦ 26-50 million	22	19.0
Total	164	100	Design-build	42	25.6	₦ 51-75 million	25	22.4
Contractor type			Labour-only	16	9.8	₦ 76-100 million	8	6.9
Indigenous	122	74.4	Total	164	100	Above ₦ 100 million	28	24.1
Expatriate	42	25.6	**Building rise**			Total	116	100
Total	164	100	Low (1-3 floors)	96	77.4	**Project duration**		
Construction type			Medium(4-7 floors)	6	4.8	Short (1-26 weeks)	48	29.6
New	122	74.4	High (>7 floors)	22	17.8	Moderate (27-52 weeks)	40	24.7
Renovation	42	25.6	Total	124	100	Long (above 52 weeks)	74	45.7
Total	164	100				Total	162	100

N=Number of respondents, ₦=Naira (Nigerian official currency)

Table 1 shows that the study covers projects owned by both public and private clients however, the majority of the projects belong to the organised private sector. The results also show that projects executed by indigenous and expatriate contractors in Nigeria were sampled however; the majority of the projects were executed by indigenous contractors. On the procurement methods adopted, Table 1 shows that projects procured by direct labour, traditional contract, design-build and labour-only procurement options were covered in the study. The results also show that low-rise, medium-rise and high-rise buildings were sampled however; the majority of the projects are low-rise buildings.

On the type of construction, Table 1 shows both new construction and maintenance/renovation works were sampled but the majority of the projects are new construction. The analysis of the duration of the projects reveals that the study sample consists of projects of short, medium and long duration. The analysis of the value of the projects shows that the study sample covered projects of both low and high values.

Level of Errors in Project Documents

To investigate the level of errors in project documents, data were collected on the errors detected in eight documents. The mean errors were analysed and are presented in Table 1.

Table 1 Ranks and test of difference in errors detected in selected project documents

Project document	N	Sum	$\overline{X}$	Rank	f-value	df	p-value	Decision
Architectural drawings	164	186	1.13	1	3.747	7	0.001	Reject
Bill of quantities	164	168	1.02	2				
Project specifications	164	144	0.88	3				
Electrical drawings	164	126	0.77	4				
Mechanical drawings	162	124	0.77	4				
Structural drawings	164	112	0.68	6				
OHS plan	164	92	0.56	7				

Quality management plan	164	74	0.45	8

N=Number of respondents, $\overline{X}$ =Mean, df=Degree

Table 1 shows that the mean of the errors detected in architectural drawings ranks first while those of bill of quantities and project specifications rank second and third respectively. The mean errors in electrical drawings and mechanical drawings rank fourth. The mean errors in structural drawings and occupational health and safety plan rank sixth and seventh respectively while that of quality management plan ranks eight. The results indicate that the errors detected in architectural drawings are the highest followed by the errors in bill of quantities. Errors in project specifications are third highest while those of quality management plan are the least.

Difference in the Level of Errors in Project Documents

The study attempted to determine whether the variation in the errors detected in the project documents investigated in Table 1 is significant or not by postulating the first research hypothesis. The hypothesis states that the errors in project documents are not significantly different. The hypothesis was tested using Analysis of Variance (ANOVA) with $p \leq 0.05$. The rule for the rejection of the hypothesis is that when the p-value>0.05, the test fails to reject the hypothesis but when the p-value$\leq$0.05, the test rejects the hypothesis. The results are presented in Table 1

The results in Table 1 show that the p-value for the test of difference between the errors in the selected documents (0.001) is less than the critical p-value (0.05) therefore the test rejects hypothesis. This result indicates that the differences in the errors detected in the documents are significant. The result implies that errors differ significantly from one document to another.

Influence of Errors in Project Documents on Project Performance

To investigate the relationship between design errors and project outcome, the second hypothesis of the study was postulated. The hypothesis states that errors in project documents have no significant relationship with project performance. The hypothesis was tested using the Spearman correlation test with $p \leq 0.05$. The rule for the rejection of the hypothesis is that when the p -value>0.05, the test fails to reject the hypothesis but when the p-value$\leq$0.05, the hypothesis is rejected. The results of the test are presented in Table 2

Table 2 Results of test of relationship between errors in documents and time and cost overruns

Project document	Time-overrun				Cost-overrun			
	N	R	p	Decision	N	R	p	Decision
Architectural drawings	80	-0.601	0.001	Reject	54	-0.467	0.001	Reject
Structural drawings	80	-0.472	0.001	Reject	54	-0.306	0.024	Reject
Electrical drawings	80	-0.472	0.001	Reject	54	-0.326	0.016	Reject
Mechanical drawings	78	-0.480	0.001	Reject	52	-0.460	0.010	Reject
Bill of quantities	80	-0.347	0.002	Reject	54	0.270	0.029	Reject
Project specifications	80	-0.553	0.001	Reject	54	-0.325	0.004	Reject
OHS plan	80	-0.251	0.024	Reject	54	-0.502	0.001	Reject
Quality management plan	80	0.075	0.508	Accept	54	-0.044	0.750	Accept

N=Number of respondents, R=Spearman correlation value, p=significant value

Table 2 shows that the p-values for the test of relationship between the time-overrun and errors in architectural, structural, electrical and mechanical drawings, bill of quantities, project specifications and OHS plan are less than the critical p-value (0.05) therefore, the test rejects the hypothesis. The results imply that the errors in the documents are significantly related to the overrun in the delivery time of projects. In other words, the errors in the documents have influence on the time-overrun recorded in the projects. Similarly, Table 2 shows that the p-values for the test of relationship between cost-overrun and errors in architectural, structural, electrical and mechanical drawings, bill of quantities, project specifications and OHS plan are less than the critical p-value (0.05) therefore, the test rejects the hypothesis. The result equally implies that the errors in the documents are significantly related with overrun in the cost of the projects. In other words, errors in the documents have influence on the cost-overrun recorded in the projects. However, the p-values for the test of relationship between time-overrun and errors in quality management plan and cost-overrun and errors in quality management plan are higher than the critical p-value (0.05) therefore, the test fails to reject the hypothesis. The result indicates that the errors in quality management plan have no relationship with the overruns in the delivery time and cost of the projects.

Evaluation of the Stage of detecting design errors

Having established that design errors have significant influence on project performance, the study investigated the stage when errors were detected. The stage is important in the efforts to control their effect on project outcome. For this purpose, three design error detecting stages namely: tendering, pre-activity execution and activity execution were identified. Data were collected on the number of design errors detected in each stage. The mean and percentage error in each stage were analysed. The results are presented in Table 3.

Table 3 Descriptive results of errors detected at selected stages of detecting design errors

Stage	N	Sum	%	$\overline{X}$	Min	Max	Stage	N	Sum	%	$\overline{X}$	Min	Max
Arch dwgs							**BOQ**						
Tendering	4	4	2.8	1	1	1	Tendering	1	1	1.1	1.0	1	1
Pre-activity	8	10	7.0	1.3	1	2	Pre-activity	5	5	5.7	1.0	1	1
At activity	29	128	90.2	4.4	1	8	At activity	20	81	93.2	4.1	1	7
Total	41	142	100	3.5	1	8	Total	28	87	100	3.6	1	7
Struct dwg							**Specs**						
Pre-activity	6	6	7.7	1.0	1	1	Tendering	1	1	1.2	1.0	1	1
At activity	34	72	92.3	2.1	2	4	Pre-activity	6	7	8.6	1.2	1	2
Total	48	78	100	2.0	1	4	At activity	17	73	90.2	4.3	3	6
Elect dwgs							Total	24	81	100	3.4	1	6
Tendering	7	7	7.1	1.0	1	1	**OHS plan**						
Pre-activity	9	9	9.2	1.0	1	1	Tendering	3	5	6.6	1.7	1	2
At activity	22	82	83.7	3.7	3	4	Pre-activity	8	15	19.7	1.9	1	2
Total	38	98	100	2.6	1	4	At activity	20	56	73.7	2.8	2	3
Mech dwgs							Total	31	76	100	2.5	1	3
Tendering	5	5	6.6	1.0	1	1	**QM plan**						
Pre-activity	14	14	18.4	1.0	1	1	Tendering	1	1	2.5	1.0	1	1
At activity	21	57	75.0	2.7	2	4	Pre-activity	6	7	17.5	1.2	1	2
Total	40	76	100	1.9	1	4	At activity	12	32	80.0	2.7	1	5
							Total	19	40	100	2.1	1	5

N=Number of respondents, $\overline{X}$ =Mean, Min=Minimum, Max=Maximum

Table 3 reveals that the majority of the errors were detected at the stage when activities concerned were about being executed. Furthermore, the minimum and maximum errors detected

per project are highest at that stage. These results indicate that errors are majorly detected at the construction stage and specifically when activities concerned are about being executed.

Discussion of Findings

The results of the study have shown that the documents rank differently in number of errors detected. The test of the first hypothesis indicates significant difference in the numbers of errors in the documents. The result indicates that errors are common features of project documents however; their extent varies from one document to another. The implication of this result is that efforts to minimise design errors are important and these efforts should be applicable to all project documents. However, the efforts should be applied more to some documents than others. Architectural, bill of quantities and project specifications with the highest number of errors require more efforts than OHS and quality management plan with the least number of errors

The results of the study reveal that the errors in all the documents except quality management plan have significant influence on the outcome of the projects sampled. The implication is that errors are capable of increasing the delivery time and cost of projects. the result agrees with the findings in the studies conducted by Tilley and Barton (1997), Love and Li (2000), Tilley and McFallan (2000), Tilley *et al.,* (2002), Andi and Minato (2003) and Love and Edwards (2004). The study has further established that the errors are often not detected at the tendering and pre-activity stages but remain until the activities concerned are being executed. The result has several implications. First, it shows that the bids submitted for the projects and indeed the contract sums and periods were inaccurate because they were prepared with the errors. Second, when errors are detected at the stage when the activities concerned are to be executed, queries are issued and works in most instances have to be suspended until the queries are answered. The process often involves change orders, rework and delay and all these often lead to claims from contractors which will make a project to overrun its budget and schedule. The point in the results of the study is that design documents are prone to errors and it is often too late before the errors are detected therefore they contribute significantly to the overrun in the delivery time and cost of projects.

CONCLUSION

The study has established that design errors are common features of project documents and the errors contribute significantly to project time and cost overruns. The conclusion of the study is that design errors impact negatively on project performance. The study also established that majority of design errors are detected at the stage when activities involving the errors are about to be carried out. It is therefore concluded that the stage when design errors are detected is too late to prevent the errors from impacting on project performance. The conclusion suggests that at the stage when project participants detect errors in the Nigerian construction industry, the correction of the errors is prone to suspension of work, change orders, rework and delay which contribute to both time and cost overruns. The import of this finding is that project participants need to put in place mechanisms for detection of design errors before commencing construction. It is therefore suggested that project stakeholders especially clients should engage consultants to carry out buildability analysis at the design and tendering stages to detect and correct design errors early enough to prevent inaccurate bids, change orders, rework and delays that can contribute to poor project performance.

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MANUFACTURER'S NEW APPROACH TO RISK

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ABSTRACT

A high performance manufacturer of waterproofing systems is motivated to: 1) minimize its risk of contractor non-performance, 2) minimize the risk of litigation by users, and 3) attract high performance contractors and end users that will install their high performance product with minimal risk of non-performance. To achieve these objectives the manufacturer must act proactively, minimize risk before it happens, and ensure that their product and installers perform. The manufacturer directed the research group to minimize their risk by 1) organizing a database of vendor performance and user satisfaction, 2) creating a requirement for past performance, tracking all warranties issued, and 3) implementing an Alpha program which used performance information to motivate a group of roofing contractors to perform and be accountable on their warranted work. Concepts utilized by the manufacturer include the concepts of any litigation is bad litigation, the use of a warranty to ensure performance decreases risk, transparency is the best way to mitigate risk, and risk can be proactively mitigated by recognizing potential risk before it happens.

Keywords: applicator, manufacturer, performance information, risk minimization, satisfaction rating

INTRODUCTION

The delivery of construction services has become a topic a source of much dismay for researchers. The last two decades of documented research has revealed a poor performance line documentation of the construction industry (Cahill and Puybaraud, 1994; CFMA, 2006; Flores and Chase, 2005; Egan, 1998; Davis et. al., 2009). Every entity in the industry claims that their service / product is high performing giving false promises to the owner. Expecting a high performing job the owner buys a service / product, but due to poor documentation of performance, manufacturers and contractors sell products based on low price and long term warranties. The false expectation of high performing job, the enticing low price and long term warranties incite clients to purchase products based on these contracts, which has no proven correlation to a systems performance (Kashiwagi 2011). At the end, the contractor

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takes no accountability for their work and the owner is dissatisfied with the service and the end product creating a "lose-lose" scenario.

This trend is also seen prevalent in the roofing sector of the construction industry. The industry is flooded with manufacturers/roofing contractors who sell roof coating systems based solely on the length of the warranties. Many researchers have suggested different type of risk minimization systems in attempt to change this trend. (Hillson, 1997; CII, 1995; Gibson et. al., 2006; Hamilton, 1996; Kashiwagi, 2009; Sullivan, 2010; Davis, et. al., 2009; Sweet, 2011).

Manufacturer's problem

This paper focuses on a large manufacturer in the roofing industry that was suffering to survive in the market due to these trends. A subject manufacturer was feeling the effects of the ill-performing construction market. This traditional market based on unproven warranty durations, low prices and poor performance made it difficult for this manufacturer to compete. The manufacturer was on the fringe of exiting the marketplace due to the high risk, high costs and low profit margin. The manufacturer claimed that their product was high performing and had no proven documentation that can support this claim.

A specific roofing sector known as Sprayed Polyurethane Foam (SPF) roofing sector is suffering to survive in the price-based market due to poor installation by the contractors. The manufacturer manufactures the coating system for this roofing sector. The manufacturer needed a process to differentiate high performing applicators from low performing applicators in this roofing sector.

Hypothesis

A risk minimization program that measures the performance of the products and applicators can minimize the risk of contractor non-performance and litigation by end users through the identification of low performing applicators and high performing end users that can differentiate the subject manufacturer from other manufacturers.

PBSRG solution

The manufacturer approached Performance Based Studies Research Group (PBSRG) at Arizona State University (ASU) for assistance. PBSRG is a group of researchers at Arizona State University organized in 1994 to develop performance based and best value procurement systems including Performance Information Procurement System (PIPS) and Performance Information Risk Management System (PIRMS). PBSRG also developed the "best value approach" that optimized value, minimized risk and optimized profit through efficient supply chain practices. The approach has been tested over 1000 projects in different services totalling up to $4.7 billion with a user satisfaction rating of 9.5 / 10 (pbsrg.com, 1994)

The most important step a potential owner can make to minimize their risk is to identify if the manufacturers and contractors have documented proven performance that will increase the probability that the roof system will last (Kashiwagi, 2011). PBSRG and the manufacturer identified the following as integral elements to an implemented risk minimization system for the subject manufacturer:

1. Identify if the manufacturers claim of high performing is true

2. Implementing an Alpha Program for sprayed polyurethane foam (SPF) roof system that uses performance information to motivate a group of elite contractors to increase their performance and be accountable for their warranted work.
3. Differentiate their products from other manufacturers by creating a structure to identify high performing applicators and end users using a warranty program.
4. Eliminate contractors that are non-performing and litigation by end users

Identification of Performance

Initially the performance of the product had to be identified. FM-SH Test # 4470 was conducted to verify that manufacturer's coating was a high performance product and can be differentiated from other manufacturer's product based on performance. The results revealed that manufacturer's coating is the only coating system that could withstand the FM-SH Test # 4470 and it was a high performing coating product (Kashiwagi 1996).

Alpha Program

A performance based roofing program known as Alpha program is developed for the manufacturer to motivate contractor performance and accountability. The program is the first contracting performance program that is established by the manufacturer that qualifies and disqualifies applicators on performance measurements determined by the end users. This program was specifically created for a specific type of industrial coatings system known as Spray Polyurethane Foam (SPF). The poor instalment and application of the SPF led the manufacturer to creating a program that would identify professional SPF applicators. The Alpha program minimizes the risk of the applicator, manufacturer and the end user creating a "win-win-win" situation. The Alpha program succinctly curtails litigation that is caused by improper application, motivates contractors to take accountability for their work and increases and creates a competitive market for ensured quality performance (Kashiwagi, et al. 2010).

Alpha program requirements:

1. Have a "good financial standing" and "be licensed" with the manufacturer
2. Roof inspections once every two years of a minimum of 25 roofs by a third-party inspector
3. Annual submission of newly installed SPF roofs over 5,000 SF to Arizona State University
4. 98% of roofs being tracked cannot currently leak.
5. 98% of surveyed roofs must have satisfied customers.
6. The contractors must attend the annual educational presentation given by Arizona State University on the risk management systems.

Applicators can be eliminated from the program if they do not meet the requirements of the Alpha program. Table 5 shows the performance ratings of the applicators currently involved in the program. The data reveals that all of the applicators are high performing applicators with 100% satisfied customers and 100% of jobs that are not currently leaking.

Job	Unit	A	B	C	D
Overall satisfaction rating of the applicator	(1-10)	9.5	9.7	9.4	9.6
Oldest job surveyed	Years	8	13	25	29
Average age of jobs surveyed	Years	5	4	10	11

Age sum of all projects that never leaked	Years	374	161	139	391
Age sum of all projects that do not leak	Years	410	171	477	484
Percent of customers that would purchase again	%	100%	100%	100%	100%
Percent of jobs that do not leak	%	100%	100%	100%	100%
Percent of satisfied customers	%	100%	100%	100%	100%
Average job area (of jobs surveyed and inspected)	SQ	40,038	28,941	50,927	40,111
Total job area (of job surveyed and inspected)	SQ	3.4 M	2.0 M	4.7 M	2.4 M
Total number of jobs surveyed telephonically	#	85	50	50	53
Total number of jobs inspected	#	31	52	27	28
Total num. of different customers surveyed & inspected	#	10	36	27	24

Table 5: Current Alpha applicator performance lines

Job	Unit	E	F	G	H	I
Overall satisfaction rating of the applicator	(1-10)	9.8	9.7	9.6	9.7	9.8
Oldest job surveyed	Years	25	29	12	20	26
Average age of jobs surveyed	Years	10	11	5	10	11
Age sum of all projects that never leaked	Years	397	376	160	293	385
Age sum of all projects that do not leak	Years	523	493	232	477	598
Percent of customers that would purchase again	%	100%	100%	100%	100%	100%
Percent of jobs that do not leak	%	100%	100%	100%	100%	100%
Percent of satisfied customers	%	100%	100%	100%	100%	100%
Average job area (of jobs surveyed and inspected)	SQ	47,481	103,558	23,271	26,173	32,554
Total job area (of job surveyed and inspected)	SQ	2.4 M	5.2 M	1.7 M	1.6 M	1.8 M
Total number of jobs surveyed telephonically	#	50	50	50	50	55
Total number of jobs inspected	#	26	30	29	27	25
Total num. of different customers surveyed & inspected	#	37	11	38	27	9

Table 5 (contd.): Current Alpha applicator performance lines

Job	Unit	J	K	L	M	N
Overall satisfaction rating of the applicator	(1-10)	10.0	9.8	9.5	9.8	9.8
Oldest job surveyed	Years	23	12	14	26	27
Average age of jobs surveyed	Years	13	3	6	6	18
Age sum of all projects that never leaked	Years	614	132	259	244	785
Age sum of all projects that do not leak	Years	655	159	278	258	863
Percent of customers that would purchase again	%	100%	100%	100%	100%	100%
Percent of jobs that do not leak	%	100%	100%	100%	100%	100%
Percent of satisfied customers	%	100%	100%	100%	100%	100%
Average job area (of jobs surveyed and inspected)	SQ	11,727	21,561	11,363	17,126	19,489
Total job area (of job surveyed and inspected)	SQ	0.9 M	1.3 M	0.6 M	1.0 M	1.0 M
Total number of jobs surveyed telephonically	#	50	51	50	54	49
Total number of jobs inspected	#	27	52	47	29	51
Total num. of different customers surveyed & inspected	#	28	33	41	21	6

Table 5 (contd.): Current Alpha applicator performance lines

Table 6 shows the overall performance line of the applicators since the inception of the Alpha program. The data shows that the overall satisfaction rating of the applicator is 9.4 out of 10 with 100% of jobs that are leak free and 99% of the customers satisfied with the job. The total roof area that have been surveyed and inspected since the beginning of the Alpha program is 80 M SF.

Job	Unit	Overall
Overall satisfaction rating of the applicator	(1-10)	9.4
Oldest job surveyed	Years	33
Average age of jobs surveyed	Years	8

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Age sum of all projects that never leaked	Years	10,144
Age sum of all projects that do not leak	Years	14,166
Percent of customers that would purchase again	%	100%
Percent of jobs that do not leak	%	100%
Percent of jobs completed on time	%	99%
Percent of satisfied customers	%	99%
Total job area (of job surveyed and inspected)	SQ	80 M

Table 6: Overall performance line

Risk Minimization Warranty Program

Based on the Alpha program, the manufacturer implemented a risk minimization program that measures the performance of all of their systems - Wall Coating, Flooring, Waterproofing, Direct Bond Roofing, and Spray Polyurethane Foam (SPF) Roofing and the performance of the applicators that install the products. In order to measure the performance of the system, clients/end users are contacted every year until the end of the warranty duration for satisfaction ratings on the product and the applicator who installed the roof system.

The risk minimization warranty program attempts to minimize risk by updating the information on:

1. Not using applicators that have no experience or do not show past performance information on successful projects
2. Concentrating on the larger investment and / or size of project
3. Identifying dissatisfied end users, and mitigating the risk immediately through annual follow-ups

The risk minimization program consists of a warranty check process outlined in Figure 1. Upon finishing a project, the manufacturer will start the warranty check process by sending the warranty to PBSRG and the applicator. As soon as the warranty is issued to the end user, PBSRG will survey the end user with the following questions:

1. Customer Satisfaction of the Applicator (1 lowest– 10 highest)
2. Would you hire the applicator again? (Yes / No)
3. Customer Satisfaction of the coating system (1 – 10)
4. Would you purchase the system again? (Yes / No)
5. Overall Customer Satisfaction (1 – 10)

The survey response information (performance information) is then reported back to the manufacturer. If a satisfaction or an installation issue is identified in the survey, the manufacturer's customer service department will receive the project information. This proactive risk minimization system enables the manufacturer to identify and resolve problems upfront, rather than becoming reactive to them as they materialize in the future.

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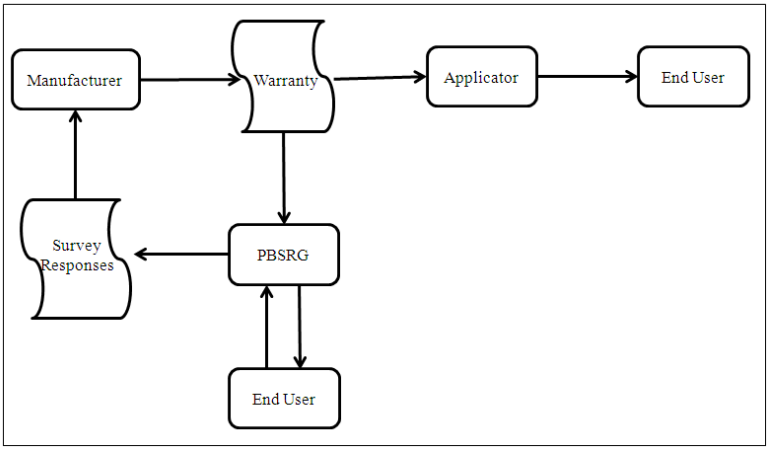

Figure 1: Warranty Check Process

Table 1 shows the performance information of all manufacturers systems over the last two years. The total job area surveyed was 18.3 million square feet. The clients were satisfied with manufacturer's product and the applicators who installed the product. The overall customer satisfaction rating was 9.1 with 674 warranted jobs surveyed. Flooring has a satisfaction rating lower than a nine because of fewer warranties issued by manufacturer for flooring. Nine out of ten flooring clients were satisfied and would use the same product and hire the same applicator again. Overall percentage of clients that would hire the same applicator again and use manufacturer's product again was 97%.

No	Criteria	Unit	Overall	Flooring	Direct Bond Roofing	Foam Roofing	Wall Coatings	Water-proofing
1	Overall customer satisfaction	(1-10)	9.1	8.3	9.2	9.1	9.3	9.0
2	Oldest job surveyed	Years	5	2	2	2	4	5
3	Average age of jobs surveyed	Years	2	2	2	2	2	2
4	Customer Satisfaction - Coating System	(1-10)	9.1	8.1	9.3	9.3	9.2	9.0
5	Percent of customers that would purchase the product again	%	97%	90%	98%	100%	98%	98%
6	Customer Satisfaction - Applicators	(1-10)	9.0	8.3	9.2	9.0	9.3	9.1
7	Purchase of customers that would hire same Applicator again	%	97%	90%	98%	97%	98%	97%
8	Total job area (of job surveyed)	SF	18.3 M	0.05 M	1.8 M	1.2 M	2.6 M	12.7 M
9	Total number of jobs surveyed	#	674	10	97	32	59	476
10	Total number of different customers surveyed	#	292	3	48	19	21	201

Table 1: System Performance Information

Table 2 shows the performance information for jobs that hold potential risk. Jobs that have satisfaction rating below seven or clients that would not purchase the product again were categorized as risky. The data shows that 97% of jobs have no customer complaints and would purchase the product again. However, the risky jobs have a lower satisfaction rating of 4.1 for the coating system and 4.5 for the applicator. The risky jobs constituted only 3% of the total job area installed. PBSRG sends a quarterly report with a list of all identified “risky” jobs to the manufacturer customer service department. The customer service then contacts the client for further investigation and the actions that need to be taken to satisfy the customer.

Criteria	Unit	Risky Jobs
Total number of jobs surveyed	#	674
Number of risky jobs	#	20
Percent of jobs that are risky	%	3%
Satisfaction rating- Coating	(1-10)	4.1
Satisfaction rating- Applicator	(1-10)	4.5
Percent of customers that would purchase the product again?	%	0%
Risky job area	SF	0.6 M

Table 2: Risky Job Performance Information

Table 3 differentiates high performing applicators from low performing applicators. Applicators that have either a satisfaction rating below seven or a client that would not hire the applicator again, are deemed as low performing contractors. The data

shows that approximately 10% of the applicators that install the manufacturer's product are low performing applicators. Low performing applicators installed 5% of the total job area of manufacturer coating.

Criteria	Unit	High Performing Applicators	Low Performing Applicators
No. of Contractors	#	268	29
Satisfaction rating- Coating	(1-10)	9.2	7.4
Satisfaction rating- Applicator	(1-10)	9.3	6.1
Percent of customers that would hire the applicator again	%	100%	69%
Total Job Area	SF	17.2 M	1 M

Table 3: High performing applicators vs. Low performing applicators

License System (Filtering out low performing applicators)

The installed risk minimization system showed that 10% of the manufacturer's applicators were low performing. In 2010, researchers proposed a license system that would severely minimize their risk by disqualifying low performing applicators to receive joint warranty options. Joint warranty contracts state that the responsibility to uphold specifications of the warranty is equally shared by the applicator and the manufacturer. By creating a system that the filters out low performing contractors, it mitigates its risk of failing warranties and litigation.

Licensing requirements:

1. Submit a minimum of five references that validates their credibility as a high performer. (One of the jobs must include the use of the manufacturer's product)
2. Survey responses from the references answering the following questions:
    a. Customer Satisfaction of the Applicator (1 lowest– 10 highest)
    b. Would you hire the applicator again? (Yes / No)
    c. Customer Satisfaction of the coating system (1 – 10)
    d. Would you purchase the system again? (Yes / No)
    e. Overall Customer Satisfaction (1 – 10)

Table 4 shows that seventy two percent of the applicators that applied did not get licensed after the introduction of the license system. Many of the applicators were disqualified due to non experience of using the manufacturer's product.

Criteria	Data
Total number of applicators applied for licensure	271
Number of applicators licensed	77
Percent of applicators that did not get licensed	72%
Average satisfaction rating of licensed applicators	9.5

Table 4: Applicator licensure analysis

CONCLUSIONS

Manufacturer has successfully identified itself as a manufacturer of a high performance coating system.

The high performance roofing program known as the Alpha program increased the accountability of the applicator through the use of documented performance information and likewise minimizing the manufacturer and the client's risk. The research showed that 100% of the roofs installed by the Alpha applicators are leak-free and 99% of the end users were satisfied with the job. The Alpha program helps the manufacturer minimize litigation and risk through the use of performance checkups, licensing practices and inspection programs. This program not only provides an on-going development feedback system to better serve clients, but helps contractors to compete in a high performance based environment.

Manufacturer has implemented a performance based risk minimization program that not only measures the performance of their coating system, but also the applicators installing the coating system through the tracking of warranties. Risk minimization program helps manufacturer differentiate themselves from other manufacturers that sell products based on warranty and low price by organizing a database of vendor performance and end user satisfaction.

The license system filtered out low performing applicators from installing the manufacturer's product. The references check requirement minimized the risk of the manufacturer by filtering out low performing applicators from using their product.

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MANUFACTURER'S USE OF END USER TO MINIMIZE RISK

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ABSTRACT

A roofing manufacturer is motivated to increase the accountability, minimize the risk and differentiate themselves from other manufacturers to increase their sales. In order to achieve this, the manufacturer directed the research group to minimize their risk by implementing a warranty program that measures the performance information of their systems and applicators by end users. The manufacturer submits a list of warranted jobs to the researchers, researchers perform a satisfaction check by calling the end users and reports back to the manufacturer. Concepts utilized by the manufacturer include the concepts of the use of warranty to ensure performance decreases risk, transparency is the best way to mitigate risk and risk can be mitigated before it happens. The research revealed that warranty program minimizes the risk for manufacturer and clients and helps differentiates the manufacturer by identifying end users that are not satisfied, applicators that are low performing, jobs that are leaking, customer retention rate and having a running log of satisfaction rating for every warranted job making everything transparent.

Keywords: end user, manufacturer, performance information, risk, warranty

INTRODUCTION

The last couple of decades have revealed a poor documentation of performance information in the construction industry (Cahill and Puybaraud, 1994; CFMA, 2006; Flores and Chase, 2005; Egan, 1998; Davis et. al., 2009). Due to poor documentation, manufacturers and contractors are selling products based on low price and long term warranty durations. The long term warranties have no proven correlation with the performance of a roofing product (Kashiwagi, 2011). The subject manufacturer realized that in order to survive in the competitive market saturated with low price and false promises, they need to differentiate themselves from other manufacturers in a dominant way that will minimize the risk of the manufacturer and the client creating a "win-win" environment.

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The subject manufacturer approached the researchers in March 2011 to propose the solutions. The researchers have identified that the contractors, end users and non-transparency are the biggest risk in any construction project. Keeping these issues in mind, researchers proposed a warranty program that tracks the performance information of all the warranties issued by the manufacturer that will track satisfaction ratings from the end users making the system transparent.

Methodology of warranty process:

The manufacturer starts the warranty process by sending a list of all the warranted jobs to the researchers as illustrated in figure 1. After receiving the list of jobs, researchers contact the end users for satisfaction ratings and direct feedback about the job. The questionnaires for the warranty process were developed jointly by the researchers and manufacturers. The subject manufacturer expressed a desire to have an end user satisfaction rating for their product, contractors installing the product, their representative present on the job site and customer retention rate. The researchers agreed that these are the critical elements for a successful roofing job and this would help the manufacturer to clearly identify the unsatisfied end users and mitigate the problem proactively. Keeping these objectives in focus, following questions were developed:

1. Satisfaction rating of the roofing system (1 lowest – 10 highest)
2. Would you purchase the manufacturers product again? (Yes or No)
3. Is the roof currently leaking? (Yes or No)
4. Satisfaction rating of the contractor (1 – 10)
5. Would you hire the contractor again? (Yes or No)
6. Satisfaction rating of the manufacturer's representative (1 – 10)
7. Satisfaction rating of the value relative to the overall project cost (1 – 10)
8. Overall satisfaction rating of the project (1 – 10)
9. Have you used manufacturer's product more than once? (Yes or No)

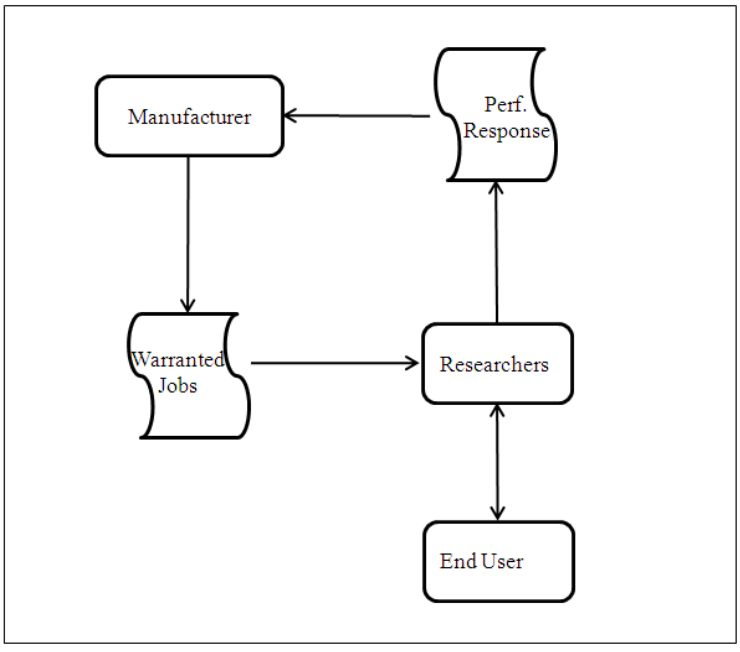

Figure 1: Warranty process

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Upon completion of the satisfaction check, the performance response (performance information) is then reported back to the manufacturer. This proactive risk minimization system enables the manufacturer to identify and resolve problems upfront, rather than becoming reactive to them as they materialize in the future.

Pilot Projects:
Before advancing any further, researchers recommended the manufacturer to conduct three pilot tests in order to test the ability of the warranty process to accomplish the desired goal of differentiating subject manufacturer from other competitors and minimize the risk:
Pilot 1 - Warranty process on largest and oldest fifty projects
Pilot 2 - Warranty process on randomized one hundred and fifty projects
Pilot 3 - Warranty process on fifty different end user projects

Table 1 shows the performance information of three pilot tests. The data reveals that the overall satisfaction rating of the manufacturer is 9.2 out of 10. The customer satisfaction rating of the roofing system is 9.1 out of 10 and 98% of the customers would purchase the manufacturers product again. There are 99% of the projects with no leaks. However, the customer satisfaction rating of the applicator is below 9.0 indicating it is essential to identify low performing applicators to minimize manufacturer's and end user's risk.

No	Criteria	Unit	Overall	Pilot 1	Pilot 2	Pilot 3
1	Overall customer satisfaction	(1-10)	9.2	8.9	9.1	9.4
2	Oldest job surveyed	Years	3	3	2	2
3	Average age of jobs surveyed	Years	1	1	1	1
4	Customer Satisfaction - Roofing System	(1-10)	9.1	8.9	9.1	9.3
5	Percent of customers that would purchase the system again	%	98%	100%	97%	100%
6	Percent of roofs with no current leaks	%	99%	98%	99%	100%
7	Customer Satisfaction – Contractor	(1-10)	8.8	8.7	8.9	8.7
8	Percent of customers that would hire same Contractor again	%	95%	98%	97%	100%
9	Customer Satisfaction – Manufacturers Representative	(1-10)	9.5	9.2	9.6	9.5
10	Customer Satisfaction - Value relative to project cost	(1-10)	8.9	8.7	8.9	8.9
11	Percent of repeat customers (surveyed)	%	N/A	N/A	N/A	77%
12	Total job area (of job surveyed)	SF	4,942,175	3,202,636	1,125,333	614,206
13	Total number of jobs surveyed	#	127	31	76	20
14	Total number of surveys	#	250	50	150	50

Table 1: Performance information for pilot tests

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Table 2 shows the percent of end users that can be contacted and the reason if they were not being contacted. The research revealed that only 52% of the end users could be contacted.

No	Criteria	Unit	Overall	50 Projects	150 Projects	50 Diff Projects
1	Bad/Missing Information (No contact info, wrong #, etc.)	%	28.4%	34.0%	26.0%	30.0%
2	Refusal to Complete	%	2.0%	2.0%	0.7%	6.0%
3	Jobs cannot be contacted	%	15.4%	2.0%	22.6%	24.0%
4	Surveys Returned	%	51.8%	62.0%	50.6%	40.0%

Table 2: Survey responses

Since end users play a critical role in the warranty process, it is essential that the response rate of the end users to increase. Manufacturers and the researchers agreed that the warranty process needed a twitch in order to meet its purpose to increase the response rate of the end users.

New warranty process

Upon addressing this issue to the manufacturer, it was revealed that the contact information was provided by the regional managers on the field and that they did not realize the importance of accurate contact information in the warranty process. In order to ensure the smooth functioning of the warranty process system it was identified that following is important:

1. The education within the organization
2. Warranted jobs submitted monthly to minimize the time between job completion and satisfaction check
3. Send a monthly list of jobs that cannot be contacted to the regional manager and request the accurate contact information

Figure 2 illustrates the updated warranty process. The difference compared to the previous process is that if the end user cannot be contacted, regional manager is responsible for providing the accurate contact information. After the accurate contact information is received, the end user is contacted again for the performance response.

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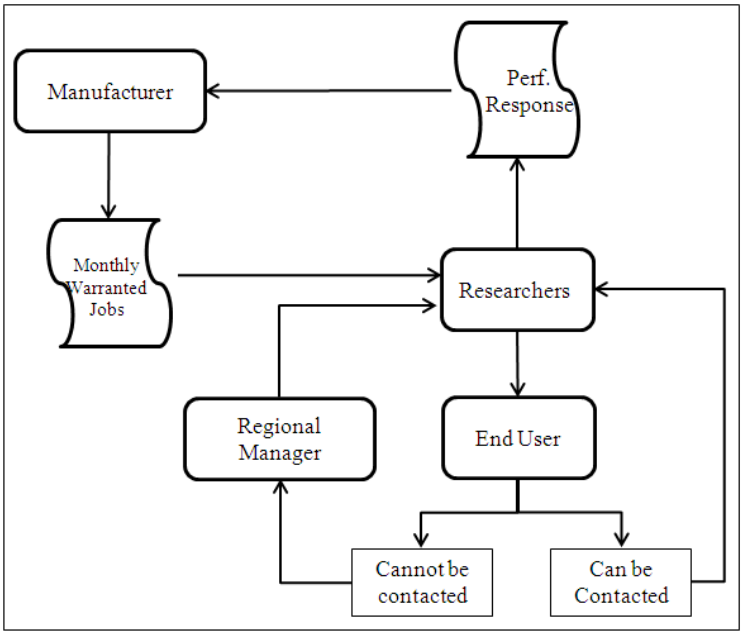

Figure 2: Updated warranty process

The new warranty process is being implemented since April 2012. Two regional managers have been trained on the warranty process. The end users for monthly list of warranties for April 2012 have been contacted. Table 3 reveals the performance information of jobs warranted in April 2012. The data is consistent with the pilot tests where the applicator is the source of risk to manufacturer due to low rating (8.7 out of 10). Roofing system and percent of customers that would use the manufacturer's product again is high. The overall customer satisfaction rating is 9 out of 10. It was identified that two of the roofs (5%) were leaking. The customer retention rate and percent of customers that would purchase manufacturers product again was high with 84% and 97% respectively.

No	Criteria	Unit	April 2012
1	Overall customer satisfaction	(1-10)	9.0
2	Oldest job surveyed	Years	2
3	Average age of jobs surveyed	Years	1
4	Customer Satisfaction - Roofing System	(1-10)	9.2
5	Percent of customers that would purchase the system again	%	97%
6	Percent of roofs with no current leaks	%	95%
7	Customer Satisfaction – Contractor	(1-10)	8.7
8	Percent of customers that would hire same Contractor again	%	84%
9	Customer Satisfaction – Manufacturers Representative	(1-10)	9.4
10	Customer Satisfaction - Value relative to project cost	(1-10)	8.8
11	Percent of repeat customers (surveyed)	%	84%

12	Total job area (of job surveyed)	SF	607,522
13	Total number of jobs surveyed	#	37
14	Total number of surveys	#	107

Table 3: Performance information for warranted jobs in April 2012

Table 4 shows that almost half of the clients are non-responsive due to incorrect contact information. The list of jobs that do not have accurate contact information are being sent to the regional manager's. Upon receipt of the updated list, the end users will be contacted again increasing the response rate.

No	Criteria	Unit	CURRENT
1	Bad/Missing Information (No contact info, wrong #, etc.)	%	15.1%
2	Refusal to Complete	%	0.9%
3	Cannot be Contacted	%	49.1%
4	Surveys Returned	%	34.9%

Table 4: Survey response for April 2012

CONCLUSION

The manufacturer was successfully able to implement the warranty program and measure the performance information of their systems and applicators as directed by the researchers. Having a documented performance proof of the performance of their systems differentiates the subject manufacturer from other competitors. The warranty program also benefited the manufacturer to minimize the risk not only for manufacturer, but also for the end users by identifying end users that are not satisfied, applicators that are low performing and having a running log of satisfaction rating for every warranted job. The manufacturer was able to mitigate the risk proactively by identifying the unsatisfied end user and leaking jobs in the warranty process.

The research also revealed that the product of the manufacturer is a high performing product. The contractor installing the product for the manufacturer was a source of risk to the manufacturer.

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MECHANISMS TO LIMIT THE RISKS OF CONSTRUCTION DELAYS IN SOUTH AFRICA

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ABSTRACT

The main objective of the research was to investigate and identify the shortcomings that exist within the current mechanisms to limit financial risks so as to develop a new method that can be used to eliminate construction cost overruns in South Africa due to delays. The study sought the views from a variety of construction professionals within their own organisations on persistent cost overruns caused by construction delays. Registered and experienced construction consultants who have practised for over ten years which include; architects, quantity surveyors, engineers, various construction professionals employed by Medium to Large Contractors, representatives from Municipal Councils and the Ministry of Public Works were selected for the survey. The research adopted qualitative and quantitative methods which allowed the use of a comprehensive literature review and questionnaire survey to gather both secondary and primary data. The respondents' responses were analysed by use of simple descriptive statistics. The findings and results of the research were used to develop new mechanisms aimed at limiting the impact of financial risks and disputes. The research is aimed at adding more value to the industry if implemented by eliminating the persistent cost overruns caused by delays which cannot be managed by existing mechanisms.

Key words: contracts, construction delays, cost overruns, mechanisms, risks.

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INTRODUCTION

The study focuses on the causes and effects of delays in-order to find out the risk impact of cost overruns in construction contracts. According to Aibinu and Jagboro (2002:593-599) a delay in construction is a situation whereby the contractor and or the project owner contribute to the non-completion of the project within the original or the stipulated or agreed contract period. Clause 29 of the JBCC Principal Building Agreement (2007:20) and the General Conditions for Construction Works (2008:25) give the contractor a right to apply for the revision of dates for practical completion due to delays caused by the employer. Kaming, et al. (1997: 830) generally agrees that the predominant causes of delays are; design changes, poor labour productivity and inadequate planning. Doran, et al. (1994:254-260) highlighted the important causes of delays as poor financing of projects and late payment for work in progress, poor contract management, changes in site conditions and shortages in materials in general. Duncan (2009:362) classifies the causes of delays as project participants and extraneous factors. He identified client-related delays as variation orders, slow decision-making and cash flow problems while contractor-related delays included financial difficulties, material management problems, planning and scheduling problems, inadequate site inspection, equipment management problems and shortage of manpower. They further identified extraneous causes of delays as inclement weather; Acts of God, labour disputes and strikes.

Client related delays

According to Duncan (2009:362) delays caused by the employer, his/her agents or directly employed contractors happen when work fails to be completed on time because the architect or some other member of the design team has failed to provide information requested by the contractor on time, or sub-contractors employed directly by the employer disrupt the main constructor's work programme. He contended that in such a case the contract would be extended and in some cases would be classified as a 'relevant event' which gives grounds for a claim of additional costs to the contractor for delays caused by the employer. Battain and Odeh (2002:67-71) found that that the most important delay risk factors are financial difficulties, late payment for works in progress, owners interference and slow owner's decision-making process. Wanyona (2004:298) found that there is limited formal application of financial risk management in cost planning and control. He further identified issues which have a significant impact on financial planning of buildings to be; the nature of price data, the accuracy of the cost advice, potentials to assess building costs, implementation of risk analysis techniques, cost impact on the budget, frequency of financial risk occurrence, the typical response to financial risk, risk management in building budget, communication of the likely cost impacts and current problems of financial risk planning and management of building projects. The main causes for payment delays in the construction industry as; delays in certification, paymaster's poor financial management, local/cultural attitude, paymaster's failure to implement good governance in business, underpayment of certified amounts by the paymaster and abuse of the use of "pay when paid" clauses in contracts (Danuri, et al. 2005:613-623). Abdul et al. (2006) conducted a survey of top management of construction companies in Malaysia and confirmed that financial problems are the main causes of delays in addition to manpower shortage. Construction payment problems have domino effects on the payment chain of construction projects since late payment due to

the contractor by the employer will also delay the payment due to the sub-contractor or suppliers who are bound in contract with him. Buys (2006:119) pointed out reasons for late payments as; either the Project Quantity Surveyor not providing the Principal Agent with the necessary payment information on time; or the Principal Agent being late in issuing the payment certificate; or the employer delaying the payment.

Contractor related delays

These include; inadequate experience, construction errors, poor site management and supervision, equipment failures or allocation problems, inadequate labour skills, site manager lacking authority, improper planning and scheduling, inaccurate estimation and poor contract management according to (Lim and Mohamed 2000:267-273). Duncan (2009:362) explains that delay caused by the contractor is a situation where the contractor fails perhaps due to a combination of lack of expertise such as labour and management skills; and so fails to complete the work on time. He adds that under these circumstances, the contractor has no real excuse for failure to complete and can expect to pay the full amount of the damages for causing delays as stated in the contract. Odeh and Battaineh (2002:67-73) indicated that inadequate contractor experience is an important factor that could be linked to the most common contract awarding procedure that is based on the tradition that the project is awarded to the lowest bidder. Zietzman (2004:105) acknowledges that all errors in the construction industry are caused by human. He continues to add that human error is very common place in human beings' lives and almost everybody makes errors from time to time while technical errors found in the physical setting out of an activity occur when a person fails to carry out a procedure and are relatively easy to identify. Zietzman (2004:105) maintain that a human can always make errors at any time regardless of the level of skill, experience or training they have. He defines errors as human action that exceeds some limit of acceptability or some allowable tolerance, a performance that deviates from the acceptable standard of practice and, a departure from acceptable or desirable practice on the part of an individual that can result in an unacceptable or undesirable result. Kanagasabapathi and Ananthanarayanam, (2005:34) have pointed out that site managers should be responsible for scheduling the activities of individual projects while the resource pool managers should be responsible for allocating the resources to the projects. Smallwood, (2006:64) points out three tasks of management as: managing a business; managing managers; and managing worker and work. He contends that although the three jobs can be analyzed separately, studied separately, appraised separately, and despite each having a present and a future dimension, management cannot separate them nor can it separate decisions on present from decisions on future. He further stated that a management leader who specializes in all the functions undergoes a systematic use of classified knowledge, concepts, principles and a common vocabulary, and who subscribes to the standards of practice and a code of ethics established by a recognized body.

Sambasivan and Soon, (2006:23) observed that many of the contractors do not own the equipments that are required for the construction work and only rent the equipments when required. They further contend that during the season when there are many construction projects, the equipments are in short supply and are poorly maintained which lead to failure of the equipment causing the progress to be hampered thereby

causing delays to the construction work. Edwards, Holt and Harris (1998:25-37) found that the construction industry relies increasing on profits generated from high utilization of mechanization, but the interruption of the mechanical supply or poor allocation not only incurs the tangible costs of labour, replacement parts and consumables but also the less tangible costs of delays to contract, possible loss to clients' goodwill and loss of profit. Lack of financial resources in education, loss of previously established facilities and staff, and a philosophy that industry should train its own employees in South Africa, denies the reality of a fragmented industry using casual labour (English and Summerville, 2004:20). Gann and Senker (1998:569-580) contended that the type of skills acquired is equally important though the current environment may not support entrepreneurship or innovation, which is required to sustain long-term performance improvements.

Fryer (2004:70) identified the three broad classes of skills as: human, technical and conceptual. He added that human skill is the managers' ability to work as a group member and build co-operative effort in the team, communicate and persuade. Technical skill includes proficiency in some aspect of the organizations work, analytical abilities and specialized knowledge. A good estimator can readily estimate the cost of a project in his area of operation, but it may not always be so for projects outside his area of operation. While cost engineers, quantity surveyors and project managers are generally familiar with the major sources of cost data in their areas of operation, they are often unaware of useful sources of cost data and related information in other areas. Buys (2006:118) investigated various methods for calculating the value of interim claims: these include accurate measurements conducted on site or rough estimates of quantities taken on site. Estimating is seen as the technical process of predicting the cost of construction. It involves the building up of rates for building elements and components based on the cost of labour, material and plant (Oladapo, Aladegbaiye and Aibinu, 2006:108-109). According to Okumbe (2009:39), the construction contract is the most critical element in the construction project because it defines the contractor's scope or work and compensation. Contract performance includes the obligation to complete the work, maintenance and defect issues, time for completion, prices, and damages (Ling and Low 2007: 240).

Consultant related delays

Preparation and approval of drawings were identified by Arditi and Gunaydin, (1998:194-203) while design errors, delays in work approval and uncompromising attitude have also been cited by Odeh and Battaineh (2002:67-71). Sambasivan and Soon (2006:27) have cautioned consultants that, when preparing the contract between the client and contractor, they should include items such as duration of contract, mechanisms to assess the causes of delay, prepare risk management plans, prepare and approve drawings on time and monitor the work closely by making inspections at appropriate times. Swain and Guttmann cited in Zietzman (2004:105) have classified errors as; time errors, qualitative errors, sequence errors and quantitative errors. He further identified common causes of human errors in the construction industry as incomplete understanding of the structural behavior and design criteria, poor judgment and problem overlooking, calculation errors, contractors' interpretation of the design and drawing to his own advantage, organizational problem, adaptation of information from different sources

without full understanding, specification ambiguity, in-experience of engineers, designers, inspectors of works, poor inspection or no regulations to provide good inspection, co-ordination deficiency between involved parties, time pressure, incomplete design and ignorance of some important and relevant characteristics. Owners' attitude could lead to diverse variables such as excessive requests of an owner, accuracy of bidding documents, quality of technical specifications and standards, owner's management ability, fairness of owner's representative, possibility of owners' payment delays or repudiation, and owner's funding capability (Kim, et al. 2008: 409).

Project attributes related problems

These are adverse factors such as unforeseen site conditions, a confined site, problems caused by neighbours such environmental pollution, unrealistic imposed contract duration, inaccuracy of project information (Ling and Lau, 2002:413-423). Kim, et al. (2008: 409) argues that sudden exceptionally inclement weather may also cause delays if it was not anticipated and therefore was not incorporated in the original contract program. They add that the physical project environment in all characteristics that define the technical nature of project characteristics and contractual conditions relates to the variables such as site conditions and climate. These variables include; differing subsurface conditions, accessibility to the site, availability of basic infrastructure in the surroundings of the site, level of community agreement with the need for investing in the project, weather conditions and influences of force majeure and the technical complexity of the project. Project duration is defined as the entire project cycle from conceptual design (after business planning) through start-up up to practical completion (David, Stuart, Andrew and Rodrigo 2004: 33). There are possible interventions caused by adjacent sites, potential delays in commissioning, conditions of material delivery, stock and assembly of resources, skillfulness of labourers and level of owners intervention in selecting local subcontractors and possible delays in project permission, (Kim, et al. 2008 : 409).

Co-ordination-related problems

Zhi (1995:231-235) identified poor communication, excessive use of subcontractors and nominated suppliers, excessive bureaucracy, fraudulent practices and kickbacks, misalignment of client's expectations and jurisdictional disputes. PMBOK (2000:17) defines project communication management as the processes required to ensure timely and appropriate generation, collection, dissemination, storage and ultimate disposition of project information. It comprises communication planning, information distribution, performance reporting and administrative closure. Emmitt and Gorse (2003) have defined communication as artifacts that add to the sum of knowledge on particular issues or more philosophically as environmental occurrences that have the potential to become sensory signals. Construction information tends to be varied and easily assumes the form of drawings, models, specifications, post data, and program schedules along other designs and management information required for the successful completion of a building assignment (Emmit and Gorse 2003 cited in Mutunga and Talukhaba 2004:190). Bowen, et al. (2006:22) defines briefing as an informative process by which the needs and desires of the client are communicated to others either officially or unofficially. A high degree of sub-contracting may lead to high risk of delays and this could cause inefficiencies in the

construction industry (Sambasivan and Soon, 2006:23). The tender evaluation method used is critical to the success of the project because it strongly affects the subsequent outcome of the project. It is traditional to select the contractor with the lowest bid after the process of pre-qualification which is based on the assumption that the pre-qualification exercise eliminates all incompetent contractors and guarantees that a pre-qualified lowest bidder will successfully execute the project, (Oladapo and Odeyinka, 2006:109). Kim, et al. (2008: 409) have stressed the importance of fairness and stability of construction laws and regulations, extent of corruption, stability of social situation, and any restriction on profit transfer specifically for oversees projects. Construction risks include social, political, economic, financial, legal, health, managerial, technical and cultural risks (Ling and Low 2007: 238). They further contended legal risk entails issues such as breach of contract by project partners or other participants, lack of enforcement of legal judgment when problems arise, insufficient law for joint ventures, uncertainty and unfairness of court justice and insolvency of a partner. Duncan (2009:362) explains that environmental related delays are caused by circumstances outside the control of either the contractor or the employer, for example exceptionally inclement weather and force majeure. Assaf, et al. (1995:45-50) found that the risks of environmental related delays are caused by natural conditions which includes inclement weather or socio-economic conditions leading to material shortage or late delivery, labour shortage and price fluctuations which do cause risks of delays in construction projects. Examples are inconsistent policies, and slow government permits, (Assaf, et al.1995:45-50). Sambasivan and Soon (2006:23) found that shortages in basic materials like sand, cement, stones, bricks, and iron can cause major delays in projects. According to Ling and Low (2007:241), enactment and formulation of new regulations and policies frequently do make it difficult to keep up with the changes.

Effects of delays in the construction industry

Aibinu and Jagboro (2002:39-46) found that delays can also result in time overruns, cost overruns, disputes, arbitration, total abandonment and protracted litigation by the parties. A project that is completed late bears the risk of causing damages to the client and the contractor (Yusif and Odeyinka 2003:105). Sambasivan and Soon (2007:25) survey found that factors such as inadequate planning by the contractors, inadequate project handling, experience of contractors, and delay in the payments for the work completed directly affect the completion of the project and cause time overruns. Yusif and Odeyinka (2003:104) have contended that the requirement to reduce cost overruns has become very critical for the governments of most developing countries including Nigeria where public funds have been dwindling over many years of economic decline. In most instances, time overrun leads to cost overruns and disputes. Dispute resolution procedures are highlighted in the JBCC Principal Building Agreement (2007:32-33) and the General Conditions of Contract for Construction Works (2008:42-46) which appears to be very involving and costly. According to Okumbe (2009:41), arbitration is the reference of a dispute or difference between not less than two persons for determination after hearing both sides in a judicial manner by another person or persons, other than a court of competent jurisdiction. Sambasivan and Soon (2006:25) concede that client related and contract relationship related factors escalate disputes to be settled by an arbitration process by engaging a competent third party that can settle the disputes amicably without

going to the courts. Malbex (2005:1-8) found that many projects were temporarily abandoned during the financial crisis between 1997 and 2000 which made the project promoters to back out because of poor cash flow and economic conditions. Litigation is an alternative dispute resolution method whereby the disputant initiates legal action against the other party by going to court (Agarwal 2001) and is normally used when all other avenues have failed.

PROBLEM STATEMENT

The research intends to formulate formal initiatives to find out what can be done to develop a new project governance management structure that can be used to avoid the unexpected construction cost overruns due to contract delays. The problem is that even with the provisions of relevant clauses which allows for extension of time in most construction contracts to manage delays the construction industry still encounter the risks of unbudgeted cost overruns.

METHODOLOGY

The research gathered comprehensive information from reliable different groups of stakeholders selected at random for the survey to find out the key causes and effects of delays in order to propose a new mechanism based on the views from the respondents. The research adopted a combined technique which allowed the used of qualitative and quantitative methods for the investigation. Descriptive and analytical survey methods which allowed the use of questionnaires to obtain data were adopted to meet the research objectives. Out of the 173 total number of the questionnaires distributed, 91 were returned and found to be properly answered and suitable for analysis. The study recorded a response rate of 52, 60% which Emerald (2003:2), agree that 50% response rate is reliable for research of this nature. The study was conducted amongst qualified registered professionals and experienced stakeholders in the South African construction industry who have practised for over ten years. A research conducted by Oladapo and Akindele (2006) also supports the reliability of the choice of qualified professionals and experienced stakeholders with over ten years experience for a research of this nature.

RESULTS AND DATA INTERPRETATION

The data gathered to achieve the results were analyzed by use of simple descriptive statistics namely frequencies and percentages as shown in the corresponding tables and figures.

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1.Owner/client	**(%)**	**Key delays**
In-adequate financial allocation & process	**48,10**	
Financial difficulties	**47,92**	
Payment delays	**35,40**	
Economic problems due to inflation	**30,38**	
2.Contractor		
Inadequate experience	**87,98**	√
Poor site management and supervision	**82,14**	√
Equipment failure and or allocation	**81,86**	√
Inadequate labour skills	**83,34**	√
Site management lacking authority	**77,13**	√
Improper planning and scheduling	**72,23**	√
Construction errors	**52,53**	√
In-accurate estimating for works resources	**33,75**	
Poor contract administration	**51,89**	√
Excessive use of sub-contractors	**70,64**	√
Material shortage and late delivery	**68,63**	√
3.Consultant		
In-accurate estimation	**61,88**	√
Uncompromising attitude	**78,19**	√
Lack of communication and project information	**58,78**	√
Design errors	**87,78**	√
4.Government		
Payment delays	**32,59**	
Economic problems due to inflation	**46,84**	
Excessive bureaucracy	**55,70**	√
Labour and permits	**48,24**	
Jurisdictional disputes	**46,15**	
Inconsistent policies	**73,74**	√

Table 1: Identification of Key causes of delays

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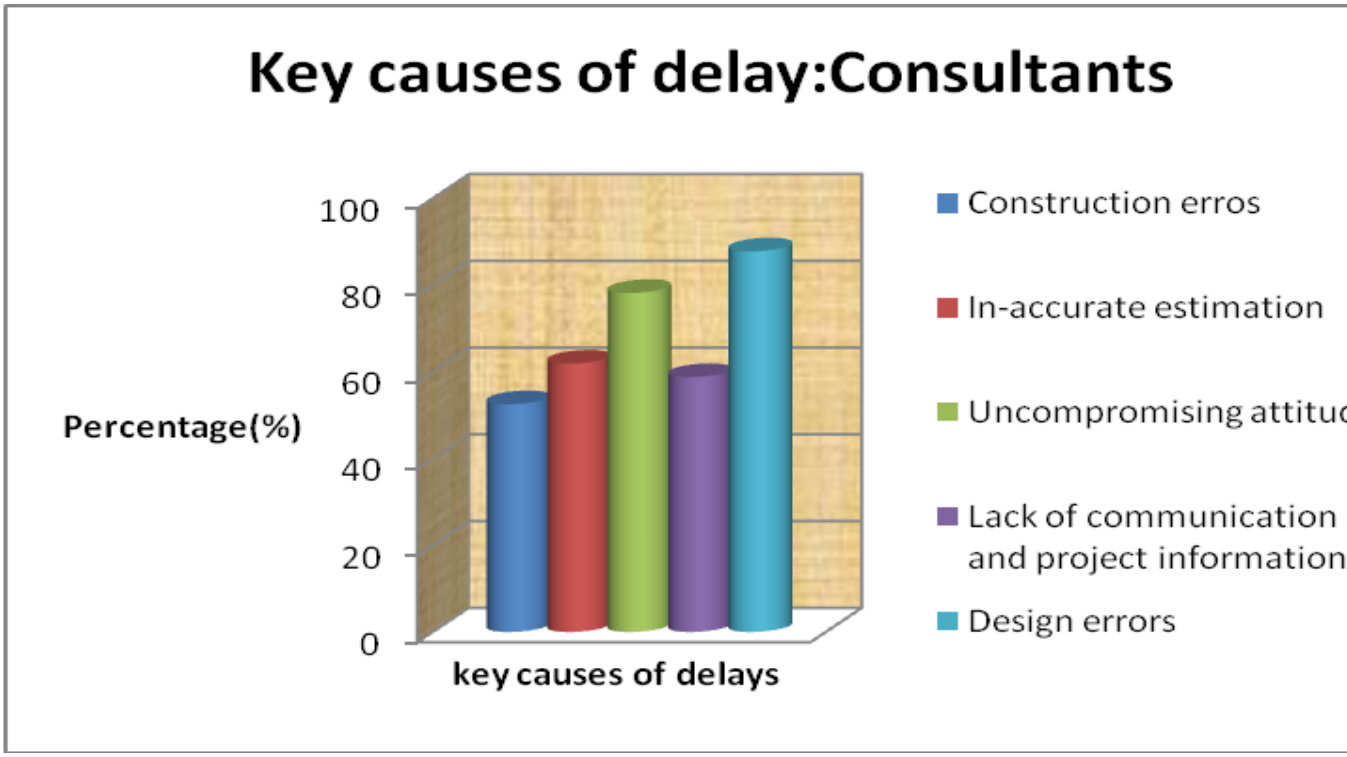

Figure 1: Identification of Key causes of delays

Consultant	Total (%)	Effects of Key delays
Construction errors caused by errors in contract documents	**50,00**	**Extension of time with costs**
Design errors	**71,74**	**Extension of time with costs**

Table 2: Effects of delays – Consultant

Government	Total (%)	Effects of Key delays
Contract duration Labour and permits	**57,14**	**Extension of time without costs**

Table 3: Effects of delays – Government

Other	Total (%)	Effects of Key delay
Site conditions and inclement weather	**72,46**	**Extension of time without costs**

Table 4: Other effects of delays

Identification of the Key delays:

The key causes of delays are presented in Table 1 and their corresponding figure 1 as shown. Table 1 shows various causes of delays against the responsible identified construction parties based on indications from the respondents on the key causes of delays. Table 1 is divided into three columns where column 1 shows a list of responsible parties and their identified causes of delays. Column 2 of Table 1 shows the results in percentages for each cause of delays. Column 3 shows the identification of key causes of delays for each responsible party by indicating with a tick for results which are over 50%. The Tables therefore categorizes the different causes of delays and responsible parties as Owner/Client/Employer related, Contractor related, Consultant related and Government

related. Tables 2 through to 4 show the effects due to the causes of delays in terms of time and costs. The first columns in all tables show a list of delays and parties responsible for causing delays. The second column shows the effect on a particular cause of delay in percentage from the responses. The third column shows the interpretation of the effect on a particular cause of a delay. The percentages were generated on data analysis based on the averages from the respondents. An indication of 50% was considered a key effect of delay. After analyzing Table 1, based on the identification of causes of delays and their responsible parties and the effects of delays, the main risks of key causes of delays were ranked from the highest to the lowest in each category as shown and presented in Figure 2. The identification of responsible parties as well as types of delays is shown in Table 1. The parties responsible were identified as the Owner, Contractor, Consultant and Government. On the other hand, the types of delays, which were already explained in literature review, are classified as:

- No extension of time with costs : The contractor gets no extended completion period or money;
- Extension of time without costs: The contractor gets only extended completion period but no money;
- Extension of time with costs: The contractor gets both extended completion period and money;
- Concurrent: The contractor may or may not get either extended contract period or money.

Out of the causes of delays presented in Table 1, only three causes, namely financial process, payments delays and economic problems were identified as client based delays without any key delay identified. This is alluding to the fact that the three causes of delays identified are all lower than 50%. The results also show that the contractor does not get extension of time or money for any delays caused by the client due to financial process, economic problems and payment delays. It is important to note that all these factors do cause delays generally to construction projects and more so affect the contractor as been identified in the literature review chapters. About eleven factors have been identified as contractors causes of delays of which nine are “key” in this category. The key causes of delays ranges between 51%, 89% and 87, 98%. Even for the key causes of delays contractors are still at risk of not given extension of time with costs since there is no key effect of delays identified in table 2. According to the literature review contractor related delays are considered to be given no extension of time and without costs. The contractor may be at risk for the imposition of penalty charges should he fail to accelerate the works to practical completion date as stipulated in the different types of contracts identified in the literature review. Unbearable penalty charges imposed on to contractors could lead to contract termination, liquidation, total abandonment and disputes hence should be avoided at an early stage of the contract.

Based on the causes of delays presented in table 1, five causes have been identified as consultant based delays of which all of the five were found to be key causes of delays which range between 52%, 53% and 87, 78%. It has been observed that contractors are awarded extension of time with costs for only two out of the five key causes of delays as presented in Table 3 notably construction errors and design errors.

Six causes have been identified as Government caused delays based on presentation in table 1 of which only two were found to be key causes of delays. The key causes of delays are 55, 70% and 73, 74% as indicated by the respondents. It has been observed that contractors are awarded extension of time with costs for only one out of the two key causes of delays as presented in Table 4. Jurisdictional disputes and inconsistent policies were not considered key by the respondents since they are both rated lower than 50%. Other causes of delays were identified as site conditions and inclement weather which respondents responded with 82, 22. Table 5 shows that contractors are awarded extension of time without costs due to delays caused by site conditions and inclement weather since respondents responded with a response rate of 72,46%.

CONCLUSION

Unexpected cost overruns can only be limited and avoided when their causes are fully identified. It is imperative that when causes of unexpected cost overruns of a particular group are known, investigated and possible solutions to control them are eventually realized then perhaps similar methods can be used in avoiding the same. The research found that out of a total number of the sixteen key causes of delays identified, Contractors' related delay is the most critical since it had nine key causes, followed by Consultant related with five key causes of delays, Government had two key causes and lastly Client/Owner who had no key cause of any delay. In general the sixteen most critical causes of delays across the four sub-headings in order of their magnitude are; Inadequate experience, design errors, Inadequate labour skills, Poor site management and supervision, Equipment failure and or allocation, Uncompromising attitude, Site management lacking authority, Inconsistent policies, Improper planning and scheduling, Excessive use of sub-contractors, Material shortage and late delivery, Inaccurate estimation, Lack of communication and project information, Excessive bureaucracy, Construction errors caused by errors in contract documents and Poor contract administration. Contractors are only granted extension of time with costs due to construction errors emanating from design errors and poor contract administration caused by consultants; labour disputes and permits caused by government. Contractors are neither awarded extension of time or money for the delays caused by client and contractors. It was also found from the study that all the proposed new mechanisms from the survey had an average response rate of 86.58% stating that they should be adopted in an effort to reduce the impact of financial risks caused by construction delays.

RECOMMENDATIONS

Based on the findings of this study the research further recommends the development of new mechanisms to limit the impact of existing financial risks in the South African construction industry. The mechanism can be used as a project governance management structure to reduce the risk of unexpected cost overruns caused by delays, stakeholders should ensure the following:

- Adequate and available sources of finance from project inception to completion to avoid project and payment delays;
- Avoid construction errors by employing experienced personnel;
- Use proper and modern construction equipment and maintain them regularly according to manufacturers' instructions;

- Adequate labour and training facilities in the market to meet the industry changing needs;
- Availability of competent and proper site management authority, proper project planning and scheduling;
- Accurate initial time, cost estimation and proper contract management are conducted by providing complete information as required;
- Competent consultant who will avoid design errors, engage in community involvement, elimination of uncompromising attitudes and ensure adequate investigation of site conditions;
- Accurate initial time estimates;
- Adequate labour in the market for construction works;
- All building related permits are done on time;
- Proper co-ordination amongst personnel, shall provide clear information and communication channels and who will avoid excessive use of sub-contractors;
- Discourage excessive bureaucracy, fraudulent practices, kickbacks and eliminate jurisdictional disputes;
- Projecting realistic contract duration, ensure that there is sufficient manpower in the market to cope with their designs and obtain permits in time before the commencement of the project;
- Develop proper co-ordination guideline structure right from the project inception stage until project completion;
- Mediation should be enforced in construction contracts by allocating time frame for its process since it has been found to the most acceptable and cheaper dispute resolution procedure used internationally.

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REGRESSION MODELLING OF RISK IMPACTS ON THE VARIABILITY BETWEEN CONTRACT SUM AND FINAL ACCOUNT IN TRADITIONAL PROCUREMENT

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ABSTRACT

The Bill of Quantities (BOQ) has been used for so long in traditional procurement. However, it has also been a subject of criticism with the critics questioning its reliability in predicting construction cost, especially as the out turn cost of many construction projects end up being at variance with the contract sum predicted using the BOQ. It is the contention in this study that it is rather the risk factors normally inherent in any construction project that are responsible for the observed variability. A two- stage approach to data collection was adopted. The first was a UK wide online survey aimed at determining the significant risk factors to focus on for modelling purpose. The second involved the collection of case study data. The analysis result from the first stage of data collection and the data set from the second stage were used to develop multiple linear regression (MLR) models for assessing risk impacts on the variability between contract sum and final account. Result of the developed model showed the potential for risk/ impact modelling and it also revealed that the relationship is not strictly linear.

Keywords: cognitive model, contract sum, final account, risk factors, regression modelling.

INTRODUCTION

Many writers and researchers have reported an observed decline in the number of contracts based on BOQ in the UK and Australia over the past 20 years. In spite of this, Davis *et. al.* (2009) maintained that the BOQ remains unsurpassed as a model on which to obtain bids and that it is a very useful tool for post contract cost control. Pheng and Ming (1997) are some of the critics of the BOQ, claiming among other things, its lack of precision in predicting building cost.

In a previous study conducted by Odeyinka *et. al* (2009) the budgetary reliability of the BOQ in procuring building projects was investigated using secondary data from completed building projects in the UK. The study concluded that in traditional procurement where bills of quantities were used to ensure cost certainty, deviations between the contract sum in the BOQ and final account figures were still observable.

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The conjecture being explored in the present study is that instead of criticizing the reliability of the BOQ, risk factors normally inherent in every construction project is responsible for the observed deviation between the contract sum and final account. The objectives of the study are two-fold, first to identify and prioritize the risk factors impacting construction cost in traditional procurement. Second, to develop and validate models for assessing risk impacts on the variability between contract sum and final account. It is envisaged that the developed models will facilitate a pro active approach to managing risk impact on construction cost.

LITERATURE REVIEW

Traditional Procurement and Risk

Winch (2010) submitted that there are usually observed differences between the contract sum and final account due to factors which are not only hard to predict but difficult to manage. Morris and Hough (1991) are of the opinion that cost overruns are caused by circumstances which are outside of the project's area of control. According to them, many projects overrun on cost for various reasons and therefore an important issue is the ability to predict such factors and the impact they will have on the project. Love et al. (2011) for instance attempted to determine the intermediary events and actions that contribute to cost overruns in social infrastructure projects. Whilst the attempt is laudable, its main focus on design error is considered limiting. As such, this study looks further to other risk factors potentially responsible for cost overruns.

Fig. 1 illustrates the 'speculative' risk to a client and contractor for specific procurement methods. Speculative risk is that which can be apportioned in advance of the project as decided by the parties in the contract (Davis *et al.* 2009). As illustrated in Fig. 1, speculative risk can wholly lie with the employer or the contractor depending on the procurement method selected. Under the traditional forms of procurement which is the focus of this study, it is evident that the more definite the BOQ is before contract award, the less is the speculative risk retained by the employer.

Fig. 1: Risk Apportionment between Client and Contractor

Source: Davis *et. al.* (2008)

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Risk perspective

The UK based Association for Project Management (APM) defines risk as ‘an uncertain event or set of circumstances that, should it occur, will have an effect on the achievement of one or more project objectives.’ (APM 2006). This definition takes into account the fact that the effect on project objectives could be either negative or positive. The US based Project Management Institute (PMI) defines risk as 'an uncertain event or condition that, if it occurs will have either a positive or negative effect on one or more of the project’s objectives', which are usually cost, time, scope and quality (PMI 2008). Some earlier definitions of risk tend to focus on the negative impacts alone. For instance Wideman (1986) defines project risk ``as the chance of certain occurrences adversely affecting project objectives". According to him risk commonly carries largely negative associations of loss or harm which generally has implications of negative or adverse effects from an uncertain event.

The definition of risk provided by APM and PMI which consider both the positive and

negative impacts of the occurrence of uncertain events is embraced in this study. However, Winch (2010) provided further illumination to risk definition offered by PMI and APM contesting that in common practice, risk is only used to refer to the probability of a detrimental effect, with the word reward being used to signify the probability of a beneficial event occurring. In order to connect with the real world, the common practice usage of the word risk has been embraced in this study to refer to the probability of a detrimental effect. This defines the premise of this research and it is our view that by minimising risk occurrence and detrimental impacts, the benefit of positive impacts will also be realised.

Winch (2010) uses the cognitive approach to partition the 'risk space' into four compartments depending on whether the occurrence of any event is either certain, impossible or somewhere in between the two. As shown in Fig 2, this approach makes a clear distinction between when a probability distribution can be assigned to the occurrence of an event and the condition where it is not possible to assign a probability distribution due to the amount of information available per time.

The cognitive model of risk (Winch, 2010) has been explored in this study to uncover the underlying risk variables impacting the variability between contract sum and final account. Using the Joint Contract Tribunal’s [JCT] (2005) Standard Form of Building Contract with Quantities [SBC/Q] and discussion with construction professionals, some of the risk factors identified include; variations by the client, change in design by client, change in scope of works, unexpected site conditions and change in design by the Architect. Others include; problems arising due to client's lack of experience, inadequate specification, extremely competitive tender, third party delays, defects in design, delay in resolving disputes, delay in nominated/ named material supplier, underestimation of quantities, local concerns and requirements, contract document conflicts, project funding problems, ambiguous contract terms, loss or damage by fire or flood.

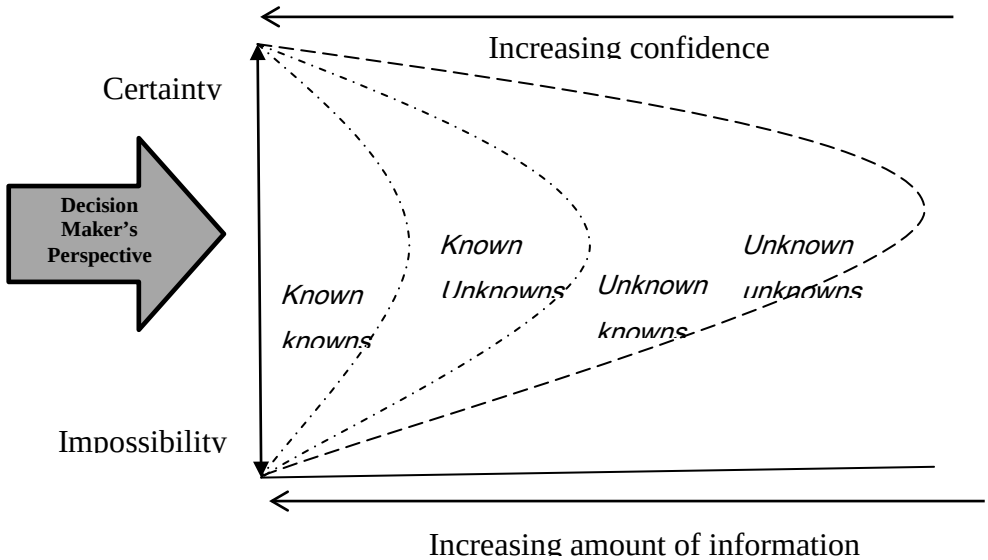

Fig. 2: A Cognitive Model of Risk

Source: Winch 2010

RESEARCH METHODS

A two-stage approach was adopted in data collection. The first was an online questionnaire survey of risk factors thought to impact the variability between contract sum and final account in traditional procurement. Data for the first stage were sourced from UK based Private Quantity Surveyors (PQS), Contractors' Quantity Surveyors, Architects and Project Managers (Table 1). A stratified random sampling approach was adopted whereby the sampling frame was drawn from available databases. In order to satisfy research ethics, a total of 348 potential respondents were emailed enquiring whether they were willing to complete an online questionnaire for the purpose of this research. Out of these, 62 replied that they were willing to complete a questionnaire. In all, 43 completed responses were received, which translates to a response rate of 69.35%. The designation of the respondents is shown in Table 1 with mean years of experience of 26.05 and standard deviation of 12.17. Using the cognitive model of risk presented in Fig. 1, it was decided to explore the domain of objective risk at project level where it will be possible for construction practitioners to provide opinion based on their experience (known known risk category).

Table 1: Designation of Respondents

Designation	Frequency	Percent	Cumulative Percent
Architect	11	25.58	25.58
Client's QS	21	48.84	74.42
Contractor's QS	6	13.95	88.37
Project Manager	5	11.63	100.00
Total	43	100.00	

Mean years of experience: 26.05 and Standard deviation: 12.17

In all, a total of 18 risk factors thought to potentially influence the variability between contract sum and final account were identified both from literature and also from

discussion with construction professionals. Using a two-dimensional scaling, respondents were requested to score on a Likert –type scale of 0-5, the extent of occurrence of the identified risk factors and their perceived impacts in case of occurrence. This then gives the measuring scale the property of an interval scale, which makes the collected data suitable for various statistical analyses.

Responses to the questionnaire survey were analysed using the mean ranking analysis to determine the relative importance of the risk factors considered. The mean score is determined as follows:

$$MeanScore = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1 + 0n_0}{(n_5 + n_4 + n_3 + n_2 + n_1 + n_0)} \quad \text{(Equation 1)}$$

Where: n_0, n_1, n_2, n_3, n_4 *and* n_5 are the number of respondents who scored the responses as 0, 1, 2, 3, 4 and 5 respectively.

Table 2 summarises the result of the mean ranking analysis for both the extent of risk occurrence and impacts of occurrence. In addition, the degree of risk was calculated by multiplying the extent of risk occurrence by risk impacts. This helps to determine the significant risk impacts to focus modelling attention on. Using PMI's (2008) risk matrix method of categorising risks, the top 5 risk factors in Table 2 came up as the significant risk factors to consider for modelling.

The second stage of the data collection involved the collection of contract sum and final account data from selected case study projects. These pair of data sets was used to determine the percentage variation between contract sum and final account. This then constitutes the dependent variable for modelling purpose. The case study projects were new build commercial projects of similar size and approximately similar construction cost. Project Quantity Surveyors who worked on the case study projects were also requested to score on a Likert-type scale, the extent of occurrence of the identified significant risk factors. This then constitute the independent variables for modelling purpose. The dependent and independent variables were then used to model risk impacts on the variability between contract sum and final account using multi linear regression (MLR) modelling method.

REGRESSION MODELLING

Using the MLR modelling method, the two sets of data collected as dependent and independent variables were combined for model development. Table 3 shows the regression coefficients obtained using the Statistical Package for Social Sciences (SPSS). Equation 2 shows the regression model obtained from the regression coefficients.

$$Y_{var} = -0.047 + 0.042X_1 - 0.035X_2 - 0.06X_3 + 0.029X_4 - 0.029X_5 \quad \text{(Equation 2)}$$

Where Y_{var} is the percentage variation between contract sum and final account
X1, X2… X5 are the 5 identified significant risk factors

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Table 2: Ranking of extent of risk occurrence/ impact and degree of risk

Risk factors	Rank	Overall risk extent mean	Overall risk impact mean	Overall degree of risk
Variations by the client	1	3.26	3.05	9.93
Change in design by client	2	3.16	2.98	9.41
Change in scope of works	3	2.74	2.86	7.84
Unexpected site conditions	4	2.21	2.26	4.99
Change in design by Architect	5	2.09	1.95	4.08
Problems arising due to client's lack of experience	6	2.07	1.91	3.95
Inadequate specification	7	2.05	1.77	3.62
Extremely competitive tender	8	1.98	1.70	3.36
Third party delays	9	1.93	1.67	3.23
Defects in design	10	1.86	1.65	3.07
Delay in resolving disputes	11	1.79	1.65	2.96
Delay in nominated/ named material supplier	12	1.72	1.60	2.76
Underestimation of quantities	13	1.65	1.49	2.46
Local concerns and requirements	14	1.51	1.47	2.21
Contract document conflicts	15	1.40	1.42	1.99
Project funding problems	16	1.35	1.37	1.85
Ambiguous contract terms	17	1.28	1.26	1.61
Loss or damage by fire or flood	18	1.07	1.05	1.12

Table 3: Multiple linear regression coefficients of significant risk factors

Risk variables	Variation
(Constant)	-0.047
Variation by the client	0.042
Change in design by client	-0.035
Change in scope of works	-0.006
Unexpected site conditions	0.029
Change in design by Architect	-0.029

Table 4 also shows the accuracy of the developed model. The coefficient of multiple correlation R which measures the correlation between the variables shows a fairly good correlation. However, the R squared (41.2%) and the adjusted R squared (7.8%)

which measure the predictive power of the model are not too promising. However, the model provides an indication that relationships exist between the variables but may not be a strictly linear relationship.

Table 4: Accuracy measurement of regression models

Measure	% Variation
R Squared	0.412
Adjusted. R Squared	0.078
Coefficient of multiple correlation R	0.642

In order to test the predictive ability of the model, 7 new cases were used for validation. Table 5 shows the validation results. The result shows a variation in prediction of between 3% and 33%. This is not unexpected due to the low measure of accuracy obtained from the R square and adjusted R squared.

Table 5: Modelling validation results

Project No.	Actual % Variation	Predicted Variation	% Absolute deviation
1	0.106	0.153	4.67
2	0.093	0.123	3.01
3	0.27	0.116	15.39
4	0.017	0.023	0.62
5	0.041	0.371	33.03
6	0.131	0.204	7.27
7	0.104	0.175	7.11

CONCLUSION

This study offers two main conclusions. First, within the limitation of the data collected, it is evident that the significant risk factors impacting the variability between tender sum and final account relate to the level of design information or lack of it at the pre construction stage. Those significant risk factors include 'changes in design', 'variations by the client', 'changes in scope of works' and 'unexpected site conditions'. This finding corroborates Winch's (2010) assertion that the more information is available at the pre construction stage, the less risk to contend with during construction.

Secondly, a predictive model was developed using the MLR method. The validation results from testing the developed model showed that the difference between the predicted variation and actual variation ranges between 3% and 33% suggesting that

the accuracy level of the model is not that promising. Despite the low level of predictive accuracy achieved by the model, the promising coefficient of multiple correlation provided an indication that a relationship exists between the dependent and independent variables which are strictly non linear. This therefore points to exploring other black box approaches to modelling.

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QUALITY RISK MANAGEMENT IN COMPLEX CONSTRUCTION PROJECTS: A CASE STUDY

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ABSTRACT

Risk management is a key project management stream which allows the project team achieve project objectives in terms of time, cost, quality, safety and environmental sustainability. There are various holistic approaches to risk identification, analysis and impact assessment and there is literature available on some aspects of construction risk management such as time or safety. However, the concept of quality risk has not attracted a similar scrutiny, as projects where quality is a dominant objective are rare and usually confidential. The robust quality management practices adopted on such schemes are too complex and expensive to be adopted in the wider construction industry; however, quality risk management processes which complement them can be applied in any construction project irrespectively of its budget and objective to drive positive change. Quality risk management processes implement quality awareness, facilitate a culture which encourages the ongoing identification and assessment of quality failures, allows the project team to assign ownership of management actions aimed at reducing the occurrence of quality failures and to align quality monitoring and reporting procedures with other project objectives' monitoring and reporting actions. This research investigates quality risk management processes implemented on a large project in the UK, from a project stakeholder perspective.

Keywords: quality management, quality risk management,

INTRODUCTION

Quality risk management revolves around management of a potential that a chosen action or activity will lead to an undesirable quality outcome (e.g., quality failure). The management of risks associated with quality involves all project management work streams and two project management work streams in particular: risk and design management. There are various holistic approaches to risk management (Zou, et al. 2009) and there is literature available on some aspects of construction risk management such as time or safety. Similarly, there is extensive literature available on quality management. However, the concept of quality risk has not attracted similar scrutiny, as projects where quality is a dominant objective are rare and usually confidential. The robust quality management practices adopted on such schemes are

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too complex and expensive to be adopted in the wider construction industry; however, quality risk management processes which complement them can be applied in any construction project irrespectively of its budget and objective to drive positive change. Quality risk management processes facilitate quality awareness and brings about a culture which encourages the ongoing identification, assessment, and rectification of quality failures. They also allow the project team to assign ownership of risk management actions and align quality monitoring and reporting procedures with other project objectives' associated monitoring and reporting actions.

With the aid of a case study it was possible to isolate quality risk management processes, methods and tools on the live project. These measures were deployed to raise the bar in terms of quality expectations on this project, to ensure that: 1) there are no mistakes, 2) outputs support the delivery of the project vision, 3) outputs exceed expectations, 4) outputs are professional in their look, feel and content and, 5) outputs are the best that can possibly be delivered (ECH 2011). They have been developed on the project, where quality is the driving objective and where the design and delivery teams are 'committed to meeting the highest standards of quality in everything that they do' and 'everyone is responsible for ensuring that their work meets the highest standard of quality'(ECH 2011). The case study sets an example of how the project quality vision and mission can be translated into a robust quality risk management plan at all project levels, allowing for: 1) robust levels of granularity, 2) maintenance of ownership collectively and individually, 3) provision of assurance that assets are safe, reliable, meet design requirements and are fit for purpose, 4) establishment of work streams and processes that are planned efficiently and effectively so that value is optimised and delivery is on time and on budget, and 5) implementation of lessons learnt following any instances where an outcome does not meet expectation.

It has to be noted, that a project selected as a case study for this research aspires to become an exemplar for how major, complex, high profile projects should be led, managed and delivered (ECH 2011).

RESEARCH METHODOLOGY

The following research methods: 1) literature review, 2) review of earlier research which included three case studies and 3) specific case study analysis, have been selected for this study. In line with this approach, there are three phases in this study: 1) investigation of existing research into quality risk management, 2) review of research (unpublished) on drivers and cost implication of quality failures in the construction industry undertaken by the researchers at Glasgow Caledonian University and 3) exploration and interpretation of the specific case study. A literature review was chosen as a staring point of this research to establish subject background, learn from other research, formulate research problems, synthesise the work of others, and compare with other research strategies (Ridley 2008). However, due to the limited availability of research in the field of quality risk management, relevant aspects of risk and design management research were reviewed. In phase two, the findings of the earlier research involving case studies was used to compare and validate approach and facilitate analysis of findings. In phase three, the findings of the earlier phases were used to analyse the case study selected to best illustrate the quality risk management practices. The case study is a live, confidential, prestigious, £4bn mix-use scheme in

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the South of England. The first phase of the project is currently at RIBA Stage C+, and remaining three at RIBA Stage B. The basis of the case study review formed project's Programme Execution Plan (PgEP) and relevant Project Execution Plan (PEP) and discussions with client representatives and project managers responsible for the project set up.

QUALITY RISK MANAGEMENT – CASE STUDY

There is a variety of quality and risk management definitions, methods and initiatives utilised in the construction industry. For this reason, the review of the quality risk commences with the baseline definitions of these terms in the researched case studies (as set out in the Programme and Project Execution Plans).

Definition of risk

Risk is the potential that a chosen action, activity or inaction will lead to an undesirable outcome (Ratliff and Hanks 1993) – a chance of, or a situation involving such a possibility. Risk management is at the heart of construction project management and revolves around the process of identification, assessment, and prioritisation of risks (ECH 2011). It is an important part of the decision-making process of all construction companies (Mills 2001) and a key project management work stream which allows to achieve project objectives in terms of time, cost, quality, safety and environmental sustainability (ECH 2011). Risk management is linked to other project controls, such as quality management, change management, schedule management or cost management. Therefore, to effectively manage project risks, all project controls have to be set up in conjunction with the risk management methodology. In the researched case study there were a total of sixteen parallel project controls and work streams, which were carefully integrated to ensure that all processes are aligned to allow their effective operation.

Definition of quality

The baseline definition of quality adopted in the case study has been described as 'a delivery of a product of the highest standard of quality and to exceed client expectations' (ECH 2011). The effective management of risk associated with such high quality requirements necessitated adoption of a very specific approach to quality: a performance-based quality system. There are two distinct approaches to quality management utilised in the wider construction industry: certification and performance-based, both of which operate on both organisational and project level. In the first, certification-based approach, a client (or client's representative) selects the project team among the firms with the relevant ISO certification, accreditation or quality kite mark to ensure that all parties involved in the project are committed to following an established quality methodology. In this approach firms manage quality within their own remit and the outcome is a product which is perceived as a sum of it parts, which is then reviewed at the end of the process to ensure it conforms to the required quality standard. In the performance-based approach, there is a continuous joint review of the team effort to improve the performance of the project. In line with this approach, everyone is responsible for ensuring that the outcome of the joint effort meets the required standard of quality. Both approaches are utilised in the construction industry, with the certification-based approach prevailing on the smaller, low end projects and performance-based systems on larger and more prestigious schemes.

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QUALITY RISK MANAGEMENT PROCESSES

In the case study, the quality risk management started at the project conception, when client's brief was developed. The client specified the relative importance of quality in relation to other main project goals -- as the main objective -- which has then been incorporated into the client brief. All relevant identified risks were captured in the bespoke risk management structure, which consists of three levels: programme, project (phase) and suppliers and contractors. This structure allows to record quality risks at the appropriate level where they will be best managed. Within this structure, all risks are further divided into three groups: threats (defined as uncertain events in the future that, if realised, will have a negative effect on project's quality objectives), opportunities (defined as uncertain events in the future that, if realised, will have a positive effect on project's quality objectives) and issues (defined as certain events that, when they occur, will have an effect on the achievement of project's quality objectives). All identified quality threats, opportunities and issues are dealt with as three separate processes following the same principles, approach and methodology.

The established risk management process consists of the following five steps: 1) risk identification, 2) risk analysis and evaluation, 3) risk action (transfer, acceptance, avoidance or mitigation), 4) risk monitoring and review and, 5) risk reporting. The key management tool in **quality risk identification** are risk registers, which contain the following information for each identified quality risk: 1) a full description of the quality risk, detailing its cause and the consequence should it occur, 2) a unique number identifying the risk, 3) qualitative risk score combining likelihood of occurrence and impact (usually combined cost and time), 4) quantification of risk (three-point estimate of risk cost), 5) action plans to manage the risk in terms of overall responsibility for managing the risk with a clear risk owner, 6) specific actions to be undertaken (including clear completion dates), 7) action owners responsible for delivering individual actions under the direction of the risk owner. The quality risks were identified with the aid of workshops, brainstorming and prompt lists. It is envisaged, that in line with the project progress, that the project management team will undertake also structured interviews with people who have relevant experience to contribute ideas and advice to contribute to the list. **Quality risk analysis and evaluation** - the 'scoring' of risks - is a vital component of quality risk management. The case study's risk register scores quality risks against both probability and impact. This allows to avoid instances where a significant amount of time is spent mitigating a quality risk when the likelihood of it occurring is negligible. Following this exercise each risk is then classed as 'Red', 'Amber' or 'Green'. **Quality risk action plans** were developed by risk owners. **Quality risk monitoring and review** is a regular and ongoing process, which involves periodic risk review meetings and risk workshops at agreed Gateways to ensure that the quality risk management procedure is being fully adhered to. The review includes: 1) technical review meetings, 2) operations and systems, 3) performance, 4) procurement, 5) supply and maintenance. **Quality risk reporting** involves: 1) risk mitigation reviews, 2) risk management meetings and 3) quantitative risk analysis. The quantitative risk analysis process will be utilised as the project progresses to quantify cost, time and performance risks on a consistent basis. In this exercise, a risk register will be quantified to create a distribution of possible outcomes and analysed using Oracle Primavera Risk Analysis software to identify the cumulative probability curve for the whole project. The process will involve

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establishment of the project baseline, its cost-loading with the cost estimate and processing using a Monte Carlo stimulation.

QUALITY RISK MANAGEMENT TOOLS

In the researched case study, risk management tools included, for example, selection of the right team, project procurement strategy, project controls, establishment of processes of governance, establishment of relevant KPIs and KRIs, verification and validation processes, baseline alignment monitoring, interventions, soft landing initiatives and provision of samples, mock-ups and exemplary units. A selection of these processes is briefly described below.

Selection of the right team

During the competitive consultant procurement process only firms with excellent quality delivery track record were taken into consideration. The project team consists of hand-picked individuals with a proven experience and excellent references from previous clients. To further address the quality objective of the scheme, consultants' fee schedules and resource levels were negotiated, resulting in an equal fees split of between design and compliance (50/50) as opposed to the proportion of between 70 and 80 per cent of resources being allocated at the design stage and between 20 and 30 per cent at compliance monitoring, which is the prevailing design consultants split in the industry. It was also ensured, that the highest level of resource is committed to the project, resulting in director-level involvement often matching the one of assistants (as opposed to between 5 and 10 per cent prevailing in the industry).

KPIs and KRIs

Key Performance Indicators (KPIs) and Key Risk Indicators (KRIs) are commonly used to evaluate the progress of a particular activity in which a construction organisation is engaged. KPIs are a type of performance measurement (Beatham, et al. 2004) which defines a set of values used to measure against. KRIs is a measure used to indicate how risky an activity is. The difference between KPIs and KRIs is that KPIs is meant as a measure of how well something is being done while the KRIs is an indicator of the possibility of future adverse impact. KPI provides information on making progress toward strategic goals, and KRI allows the project team to identify potential event that may negatively affect continuity of the particular construction activity (or a whole project). Both indicators are reliant on understanding of client's strategic goals (i.e. what is important for the client) and depends on a project organisation. In the researched case study there are common indicators for all firms involved in the delivery, which were set by the project manager. On smaller projects there is rarely a 'centralised' KPIs and KRIs system, which results in every firm measuring their own performance in line with their own, bespoke set of standards, for example engineering firms have different internal KPIs than contractors involved in a delivery of the same project. This situation, due to inconsistency of approach, creates additional quality risks. In the researched case study, KPIs and KRIs included, among many other, number of industry awards, media coverage (positive and negative), environmental performance, continuous development of people and stakeholder and client feedback. An example of established stakeholder and client feedback KPI included a quarterly delivery team performance review (engagement scoring) survey employed to monitor and measure client's perception of service quality. The survey is based on the SERVQUAL method, which focuses on ten dimensions measured on a scale from 1 to 5, and is available online to all team members via surveymonkey.com.

Verification
Verification is a suite of processes, which allow the team members to check whether a product or service meets specifications and project objectives. It includes three parallel work streams: desktop study and paper trail, commissioning and inspections. In the case study, desktop study and paper trail includes many design checking processes such as brief tracking (process of monitoring of alignment of deliverables with the client brief) and traceability (process of recording all changes occurring throughout the development and linking them to the original client brief) processes. Commissioning, a multi-phase process that ensures that the interacting systems in a building are properly installed and operating (Akin, et al. 2004), due to the early design stage is concerned with whether the programme and design are delivering the client's desired functionality (whether they are compliant with specifications and client's brief). In the later stages, this performance verification tool will focus on: 1) Ensuring that the performance of the selected building equipment matches design specifications and delivers the intended functionality, 2) All installed building equipment is tested in an operational environment to validate the functionality of the solution and that 3) Training and familiarisation of the facilities management, maintenance contractor and end user representatives has been completed (Akin, et al. 2004). Inspections, which are 'field' reviews which aim to establish whether the finished works meet client brief and whether all components properly fit together, is scheduled to be carried out throughout the whole construction process and includes a structured final inspection regime to ensure that all defects identified during the construction process have been rectified and the finished works standard reflects approved benchmarks (set out in the approved samples, mock-ups and exemplary units).

Testing
There are various testing regimes utilised in the delivery of construction projects, which can be divided into three groups: regimes driven by legislation, regimes which are part of the building delivery and commissioning and additional, 'voluntary' ones. In the researched case study, the 'voluntary' testing regimes include, for example, additional (40 per cent) façade water hose testing in addition to the 'standard' 10 per cent of the façade area carried out as a building delivery testing.

Validation
Validation is a processed of acceptance of buildings' design and works. The design is validated (i.e., the compliance with the specifications and alignment with project objectives is confirmed) on the basis of the relevant design team report, client review, audit or designated person's (for example project or programme director's) judgement and interpretation of evidence. The need for the design validation stems from the fact that the design usually evolves throughout the delivery process which significantly increases the risk of quality failure.

Samples, mock ups and exemplary units
Samples, mock ups and exemplary units are construction best practice tool allowing the contractor to identify any buildability issues, identify opportunities for pre-fabrication, sequencing strategy, and to provide quality standard benchmark for subcontractors and suppliers to understand (and be measured against). Samples, which will be required in the researched case study include, for example, stone for the facade, grilles, wall panels, timber flooring internal stone or carpets. The examples of mock ups which will be required include floor and wall junctions, bulkhead details,

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shadow gaps and doors (with ironmongery, frame and architraves). The examples of exemplary unit typologies include a full apartment (to understand spatial relationships, interfaces and performance and to reduce amount of rework). It is usually expected that all exemplary units and selected mock ups are fully functional, including, for example, working ventilation to test acoustics or water supply pressure.

The design team is expected to identify samples, mock ups and exemplary unit requirements early in the design process and there is a set, rigorous pre-contract and post-contract samples, mock ups and exemplary units sign off process in place.

Soft landing

There is also a provision for an initial 'shakedown' period identified by Brand (1984), which occurs when the end user moves in. At handover a building goes through a stage of a 'shock', in which the systems which were installed correctly, tested and certified occasionally malfunction and require adjusting in line with the end user specific 'manner' of building exploitation. The focus of soft landing is on handover and post occupation after care. Its purpose is to provide the structure for project teams to stay engaged after practical completion, assisting the client during the first months of operation to fine-tune and de-bug building's systems and to ensure that the occupiers understand how to control and best use their new work environment. It includes procedures and example checklists which act as signposts for design teams to help end-users get to grips with their unfamiliar and complex buildings and allows for a full programme of post-occupancy evaluation.

CONCLUSIONS

It is widely recognised in the construction industry that quality cannot be 'inspected into a project at the eleventh hour' but 'built into every stage of the process via the 'right first time approach and systematic checking process' (SRM 2011). To ensure that this process is implemented and robust, and that every outcome maintains the required standard of quality firms delivering large, prestigious construction schemes utilise a number of quality, design and risk management processes and tools. The robust design and quality management practices adopted on such schemes are too complex and expensive to be adopted in the wider construction industry, as the cost associated with the deployment of performance-based methods on the organisational and project level (appointment of more expensive firms, additional professional appointments, additional scope elements for consultants, deployment of expensive measures such as mock-ups and exemplary units, additional testing and inspection regimes, specific procurement methods) is significant. However, as found in this research, quality risk management processes which complement these expensive design and quality management provisions can be applied in any construction project irrespectively of its budget and objective to drive positive change.

It is hoped that the quality risk management approach discussed in this paper will contribute to the research in the field of design, quality and risk management and project controls set-up on construction projects, so engendering a culture of continuous improvement.

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REINSTATEMENT OF FLOOD AFFECTED PROPERTIES: EXPERIENCES OF SMEs AFFECTED BY THE 2009 COCKERMOUTH FLOOD EVENT

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ABSTRACT

Recent policy changes in the UK encourage at-risk communities to learn to live with and adapt to flooding. Adaptation of individual properties by embracing resilient and resistant measures is an important aspect endorsed therein. Uptake of such protection measures by property owners, including that of Small and Medium-sized Enterprises (SMEs), has traditionally been low. A post-flood situation offers an opportunity to reinstate / reconstruct by integrating flood protection measures, in such a way that reduce damage and enhance the ability to recover in the event of a future flood incidence. In order to investigate the reinstatement / reconstruction experiences of flood affected SMEs, those affected by the 2009 Cockermouth flood event were studied. The results of a questionnaire survey revealed that many SMEs have opted for traditional reinstatement rather than resilient reinstatement. A detailed case study revealed requirements of getting the business back and running as soon as possible, a lack of guidance and advice from professionals and financial concerns as some of the barriers faced by SMEs. It is important that SMEs are provided with necessary guidance during the post-flood reinstatement stage, in order to make sure that the opportunity to build back better, integrating flood-protection measures is grasped by the SME owners. Stakeholders related to the construction industry, who are actively involved with post-flood reinstatement work, have an important role to play in this regard, providing necessary guidance and expertise to flooded SMEs.

Keywords: adaptation, flood, resilience, reinstatement, SMEs

INTRODUCTION

Flooding is a hazard that affects communities in the UK regularly. Flooding could occur in different forms, and the most commons forms in the UK include river, coastal, surface water, sewer, and groundwater flooding (Environment Agency, 2009a). Consequently, a considerable proportion of properties in the UK remain at risk of flooding. Figures published by the Environment Agency identified that about 5.2million properties in England; amounting to one in six, remains at risk of river,

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coastal or surface water flooding (Environment Agency, 2009b). Acknowledging that it is not technically, economically or environmentally feasible to prevent flooding altogether (Defra, 2011), recent policy changes in the UK encourage at-risk communities to learn to live with and adapt to flooding. Accordingly, a greater emphasis is placed upon property-level flood protection. For example, the National flood and coastal erosion risk management strategy for England (Defra, 2011) that complements Flood and Water management Act 2010, declared that one of the ways that the government seek to reduce the threat of flooding as by "increasing public awareness of the risk that remains and engaging with people at risk to encourage them to take action to manage the risks that they face and to make their property more resilient" (Defra, 2011: 14). It further goes on to say that "householders and businesses at flood risk should take the appropriate steps to better protect their properties through property level resistance and resilience measures" (Defra, 2011: 26). A part of the responsibility of safeguarding against flooding is thus expected to be taken by at-risk communities; including households and businesses.

A post-flood situation offers a window of opportunity to integrate property-level flood protection measures to the existing building stock, by opting for flood resilient and resistant reinstatement. Wassell et al (2009) reported that property owners in areas at risk of flooding could benefit from resilient reinstatement following significant flood damage, given that it is more cost-effective to implement at that time. Further, previous studies have reported that flood affected property owners are likely to opt for such measures, than those without flood experience (Kreibich *et al.*, 2007; Harries, 2008). However, uptake of property-level protection measures is not without barriers. Lamond and Proverbs (2009) categorised such barriers in to four; financial, informational, emotional and timing constraints. If the issue of financial constraints is taken as an example, additional cost can be cited. Wassell et al (2009) calculated that the cost of resilient reinstatement of a domestic property could on average be 40% higher than that of traditional reinstatement. Similarly, Joseph et al. (2011) found that mean percentage additional resilient cost to be about 34% for residential properties flooded to depths of between 100mm - 1000mm during the 2009 flood event in Cockermouth.

Whilst previous work has dealt with post-flood reinstatement of households to a certain extent, studies focusing on the business sector; especially SMEs, is limited. This paper seeks to discuss findings of research work undertaken to investigate the uptake of property-level flood protection by SMEs during post-flood reinstatement of flood damaged property. The paper first presents the research method adopted, followed by findings of the research. Discussion of the findings lead to conclusions drawn and recommendations made subsequently.

RESEARCH METHOD

In order to investigate the reinstatement / reconstruction experiences of flood affected SMEs, those affected by the 2009 Cockermouth flood event were studied. Leading up to 2009 flooding in Cockermouth, approximately one month's worth of rainfall had fallen in the space of 24 hours and the impacts had been worsened by peaking flows in both the River Cocker and the River Derwent at similar times (Enviornment Agency, 2011a), leading to flood depths of over 1.5m in Cockermouth (Environment Agency, 2009c). Flooding in November 2009 had affected about 225 businesses directly (Cumbria County Council, 2010; Tickner, 2011). Although Cockermouth has experienced flooding before 2009 in the recent past; in 2003 and 2005 as well, the

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event of year 2009 was seen as unprecedented due to the scale of its impact, and, therefore, provides a useful case study of repair and reinstatement of flood affected SMEs.

Information from SMEs was collected via a questionnaire survey as well as case studies. 48 SMEs were involved in the questionnaire survey, whereas 9 of them were studied further during the case study stage. Questionnaire survey reported a response rate of 25%, amounting to a reasonable response rate in comparison to previous studies of similar nature. SMEs studied were mostly micro sized businesses with less than 10 employees, going in line with the size-wise distribution of businesses in Cockermouth and the UK in general. Face-to-face interviews were conducted with the ownership, senior management of selected case study SMEs, in order to gather the required information.

FINDINGS

Post-flood reinstatement / flood protection

36 SMEs involved in the survey were directly flooded in November 2009, and hence required reinstatement work to be carried out to their business premises. Out of the flooded SMEs, half of the respondents had implemented at least one property-level flood protection measure to safeguard their business property in a future flood event. Measures such as reviewing property insurance, raising electrical sockets / wiring, and relocating vulnerable / important stocks / equipments to an upper floor were the most commonly implemented flood protection measures adopted by the SMEs (See Table 1). In half of the cases, SMEs had implemented 3 or more protection measures, suggesting that businesses who decide to enhance their flood protection are likely to choose a combination of such measures. However, uptake of property-level resistant measures such as flood barriers and resilient measures such as resilient flooring and wall finishes had been limited.

Table 1 – Flood protection measures implemented (Wedawatta *et al.*, 2012a)

Flood protection measure	As a % of businesses opting for flood protection
Reviewing property insurance	44%
Raising electrical sockets / wiring	33%
Relocating vulnerable important stocks / equipments to upper floor	28%
Obtaining property insurance	22%
Flood resilient flooring / floor finishes	22%
Obtaining temporary flood barrier(s)	22%
Conducting a flood risk assessment on property	22%
Storage of stocks / equipments above floor level	11%
Flood resilient wall finishes	11%
Remedial works to seal water entry points	11%
Other	28%

Resilient measures that attempt to minimise the impacts of flood waters on property, can be integrated to a property at the post-flood repair and reconstruction stage, by means of resilient reinstatement. During the reinstatement stage, SMEs had the alternative of either opting for like-for-like reinstatement to their flood damaged property, or opting for resilient reinstatement, thereby enhancing future flood protection. However, a comparison of the numbers of businesses opting between these

two types of reinstatement measures demonstrated that a majority had chosen like-for-like reinstatement. As shown in Table 2, 26 SMEs had said that they either repaired or replaced their wall finishes, but only 2 SMEs had opted for resilient wall finishes.

Table 2 – Comparison of like-for-like reinstatement and resilient reinstatement (Wedawatta *et al.*, 2012a)

Like-for-like reinstatement	Nr	Resilient reinstatement	Nr
Repairing / replacing wall finishes	26	Resilient wall finishes	2
Repairing / replacing floor finishes	24	Resilient flooring / floor finishes	4
Replacing doors	19	Flood proof external doors	0
Replacing windows	12	Flood proof windows	1

The difference observable could be partly due to SMEs lacking the relevant technical knowledge regarding the measures that had been implemented. Further, SMEs might not have known the exact work undertaken, as some had left the entire process in the hands of their insurance company or the building contractor. Considerable differences between the number of SMEs opting for resilient and like-for-like reinstatement suggest that the opportunity to build back better has not been embraced by many flooded SMEs and that much needs to be done to increase the uptake of resilient reinstatement.

Reasons for not opting for resilient reinstatement

When asked the reasons for not opting for flood protection measures, a major reason given by the SMEs surveyed was that it is the responsibility of the landlord to carry out property-level flood protection measures. This corresponds with the fact that nearly 60% of the survey sample were in rented and leased business premises, rather than in freehold property. Belief that flooding will not affect their property again in near future, reliance on insurance, and cost of protection measures were the other significant reasons cited by SMEs involved in the questionnaire survey. During the case study interviews, reasons for not opting for resilient reinstatement / property-level flood protection were further investigated. Issues mentioned by flooded SMEs are discussed below, under the categories identified by Lamond and Proverbs (2009). It has to be kept in mind that in addition to these categories, one of the key reasons mentioned by SMEs was the inability of SMEs in rented and leased properties to undertake resilient reinstatement and flood protection, as mentioned above.

Cost of property-level flood resilience and resistance measures and lack of financial incentive in terms of cost of insurance despite implementing such measures were two financial concerns often mentioned by SMEs. A SME director responding on resilient reinstatement commented that “the cost is prohibitive. No sign of the insurance companies’ policies being reduced by them”. As discussed earlier, resilient reinstatement is likely to be costly than normal reinstatement, although the benefits may outweigh costs if the risk of flooding is significant. For example, the Environment Agency (Thurston *et al.*, 2008) calculated that property-level flood resistance measures are economically beneficial for a business if the risk of flooding is greater than 4% (twenty five-year return period), whereas property-level resilience measures are beneficial if the risk of flooding is greater than 10% (ten-year return period). Further, Douglas et al. (2010) reported that flooded property owners implementing resilient reinstatement and additional flood protection measures are negatively affected by non-betterment clauses and inactivity of insurers. Inactivity of insurers, in terms of not providing an incentive for uptake of resilient reinstatement as well as not promoting the uptake of such measures, was noted in this research. For an

example, insurance may incentivise flooded SMEs either by keeping their cost of insurance at pre-flood values or even below, if resilient reinstatement is undertaken. It was found that flooded SMEs had experienced higher cost of insurance and higher excesses after the 2009 event (Wedawatta *et al.*, 2012b). This has been the same for the case study SMEs who had opted for resilient reinstatement measures as well. This suggests the proactive role that has to be played by the insurance industry, in increasing the uptake of flood protection by SMEs. It was also noted that much of the grant schemes made available to promote flood protection of properties were limited for households, and excluded business establishments. A micro-sized SME owner mentioned that his application for a grant to install flood barriers was not approved, as that particular scheme excluded business properties. It was suggested that such grants should also be available for small businesses, so that they can be better prepared for the future.

Informational barriers cited included lack of as well as in certain cases overloading of information on property-level flood protection. Case studies with SMEs revealed that some SMEs whose premises were significantly damaged by flooding, and thus required extensive reinstatement, had not received adequate guidance on flood protection. For an example, a SME who had overseen reinstatement works of its property by the business itself commented that it was not made aware of possible resilient reinstatement measures and that it was not sure whom to approach for this advice. Conversely, it was also noted by some SMEs that there were many commercial businesses; contractors, suppliers, professional advisers, etc, marketing their products and services during the aftermath, adding to the confusion among flooded SMEs as to what to be done. Excessive marketing activities of such commercial organisations had also forced some SMEs to completely ignore such approaches. This might have contributed to valid information not being received by SMEs even through reliable sources, due to flooded SMEs getting used to ignore such approaches. It was mentioned that, although the advice was available if it was looked for, selecting between the sources was a problem for flooded small businesses. These concerns were echoed in a Defra consultation (Defra, 2008) which found that whilst it was difficult for individual property owners to select flood protection measures with confidence unless they have expert advice, such advice is likely to be treated with suspicion if comes from a source promoting a particular product. Therefore, the need for independent expert advice was highlighted. The case study findings suggest that there is scope for improvement in flood reinstatement and protection advice provided to SMEs. For example, one SME owner stated that some of the plastering collapsed due to improper drying techniques adopted. SMEs pointed out several situations where SMEs were provided with incorrect advice by building contractors and consultants employed, without considering the nature of buildings, existing construction methods, and regulations concerning listed buildings. Therefore, there seems to be a role for a reputable organisation like the Environment Agency, and professional associations like the RICS to step in, and provide technical expertise through its membership.

Emotional barriers elicited from comments of SMEs included perceptions that flooding will not affect their property again in near future, property will be flooded even with property-level protection, and that the responsibility of ensuring protection lies with the national and local government bodies. Some SMEs viewed that flooding of 2009 as unprecedented, and an event of similar scale will not occur in the near future. As Lamond and Proverbs (2009) discussed, ownership of the problem of

flooding is also highly emotional. SMEs viewed that it was the responsibility of the national and local governments to provide protection against the risk of flooding, particularly through community-level structural flood protection and regular river maintenance. It was noted by SMEs that regular maintenance of the rivers Derwent and Cocker in Cockermouth has to be carried out to minimise the risk of flooding. It was mentioned that dredging, which once used to be about once a year, was later changed to once every three years, and latterly river dredging has not been done for years. This was identified as an important step towards minimising future flood risk, rather than measures at the individual level. A new £4.4 million flood alleviation scheme for Cockermouth is now in progress to reduce annual risk of flooding to 1% (Enviornment Agency, 2011a). Further, the Environment Agency claimed that the river channels are surveyed annually to determine the level of maintenance work required, as part of its risk based approach for the removal of gravel in areas where the risk of river flooding is high (Enviornment Agency, 2011b). For some SMEs, strain of having to manage reinstatement of both their home and business was an issue. SMEs viewed the trouble and efforts of having to recover from another flood event in the near future might be too much for some of the businesses, who had already undergone the stress of a major flood event.

A common timing constraint cited was the priority of SMEs at the time to start their business back as soon as possible, after completing reinstatement work swiftly. Loss of business activities for a considerable period of time is particularly damaging for SMEs, whose only income may be lost during that period, and thus the priority had been to reinstate flooded property as soon as possible. This has discouraged SMEs to consider lengthy negotiations with insurers, planning authorities etc. It was mentioned by the SMEs that there were significant delays due to different parties insisting on their way of working, rather than coming to consensus and progressing with the work. Hence it was suggested that there has to be communication and co-operation between different parties involved in planning, obtaining approval and carrying out refurbishment activities, especially as many of the flooded buildings were listed historic buildings.

CONCLUSIONS

Previous research has revealed that resilient reinstatement is more costly than that of like-to-like reinstatement of flooded properties. However, benefits of flood protection to properties are likely to outweigh costs for properties in areas of higher flood risk. Benefits may be higher for SMEs, considering the stocks and equipments of a business, and factors including loss of income and potential for loosing customer base during the time a business is closed after flooding. Therefore, although the cost is high, given the significant increases in excess of property insurance and level of flood risk in Cockermouth, resilient reinstatement could well be beneficial for SMEs in the long run. Although the 2009 flood event provided a good opportunity to build back better for flooded SMEs, this opportunity does not seem to have been grasped by a majority of SMEs affected.

Over half of the SMEs surveyed were in rented or leased business property, and this was cited as a major reason restricting the ability of individual SMEs to safeguard their property via property-level flood protection measures. In this regard, further interventions seem needed to encourage landlords to make adaptation interventions, to their rented properties. SME owners, especially micro business owners, are further restricted by the fact that grants and financial assistance provided to adapt properties

to flooding are often limited to households. It is important that such financial assistance is made available to SMEs, especially to smaller businesses that are often restricted by financial constraints.

Dependence of SMEs on their insurance policies to recover following a flood event is well known. Insurance companies are therefore significantly involved in reinstatement activities, either directly or indirectly. As a result, insurance could be an effective source of promoting property-level adaptation during this stage. Such activities could be further encouraged by insurance companies, via initiatives such as lower insurance premiums and reduced excesses. However, non-betterment clauses in insurance policies and the free market situation where policy owners are able to switch their insurance company seem to discourage insurance companies to be actively promoting flood adaptation among their flooded policy holders during reinstatement. There seems to be the scope for a government led initiative to facilitate adaptation of flooded properties either via insurance companies by incentivising them for the additional investment or by making grants available to individual SMEs.

For most SMEs; especially to SMEs with a single business premises, restoration is vital for the successful continuance of the business in the aftermath of a flood event. Therefore the priority of SME owners at the time has been to restore their business premises as soon as possible, rather than to explore opportunities to build back better or to invest time and efforts to investigate ways and means of adapting their business premises to sustain a future flood event. In this regard, it is important that SME owners are provided with necessary guidance and advice in a timely manner following a flood event.

Some SMEs whose premises were significantly damaged by flooding, and thus required extensive reinstatement, had not received adequate guidance on flood protection. Post-flood advice and guidance often seem to focus on households, limiting the ability of SMEs to receive information specific to businesses. It is important that SMEs are provided with proper guidance at this stage, and directed towards the necessary professional advice if required. The role of local councils and local business networks is vital in this regard, who have a direct relationship with SMEs. Further, stakeholders related to the construction industry, who are actively involved with post-flood reinstatement work, have an important role to play in this regard. It has to be ensured that SMEs are provided with accurate guidance and professional advice, at a time where they are likely to be subjected to a high degree of trauma and stress and are forced to engage in reconstruction activities that they are not familiar with.

Recent changes in national policy encourage communities to adapt to flooding and be resilient, by opting for property-level protection measures. Although widely advocated, costs and perceived benefits of such measures are seen as a barrier for their uptake. Higher costs of insurance and excessive excesses could mean property-level protection is more beneficial for at-risk SMEs. Further research in this regard is needed, in order to assess this phenomenon and develop the knowledge base on benefits of property-level adaptation to at-risk SMEs. These issues are likely to affect cost / benefit of resilient reinstatement and property-level flood protection for SMEs. Factors that motivate SMEs to implement resilient reinstatement is worthy of further investigation and further research in these areas is recommended.

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"HOUSING FOR ALL" DEVELOPMENT PROJECTS BY THE GOVERNMENT AS A TOOL FOR CREATING EMPLOYMENT

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ABSTRACT

The purpose of this study was to highlight the lack of labour- intensive construction methods that are used on low-cost housing projects sponsored by the South African government. Using observations, interviews and questionnaires this research was conducted on as a case study in a development area called Tshepiso Township, South of Johannesburg. This research has proven that with the labour-intensive method it is possible to work on low-cost houses using a minimum budget. The community will get skills and employment leading to housing for all. Employment creation in the construction industry is also sustainable. Due to high urban migration, housing, unemployment and services have become a major source of protests in the cities, because of shortages. This study was limited to the Construction industry activities in the province of Gauteng in the city of Johannesburg. It is recommended that all interested contractors would be required to design a labour-intensive work programme before tenders are awarded and commencement of the project.

Keywords: employment creation, labour intensive, low-cost housing,, poverty alleviation, public funding and squatter camps.

INTRODUCTION

This research was seeking to find ways of alleviating unemployment through labour intensive construction methods on government funded housing development projects in South Africa. The study was making a follow up on the strengths and weaknesses of the current contribution of the construction industry towards the economic development through the infrastructural development. This development runs into excess of over billions of rands every year in the annual budget of the government meant to provide houses for all.

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According to the South African constitution 1996;108, "Everyone has the right to adequate housing; the state must take responsible legislative and other measures 's within its available resources, to a the progressive realization of this right" With this task in mind the government according to Wohlmuth (1997) a programme entitled Reconstruction and Development Programme (RDP) was launched through the department of Human Settlement in collaboration with the department of National Housing to address the housing shortage in the country.

Background

In 2000 Irene Grootboom a South African housing rights activist who had been left homeless after an eviction from an informal settlement took the government to court demanding their right to housing.

According to researches that were conducted by Evans 2001, Eds Kook and Gelderblom 2003; p266, and Leckie 1990 the courts did pass the verdict that section 26 guarantees the right to have adequate housing it also guarantees every child's right to basic shelter. It therefore led to a decision that the people could not be evicted unless the government had provided alternative housing which meets the expected basic standards. These houses would enable the people to vote, as one would need to have a recognized address in order to carry out this right. However Leckie (1990) went on to say that housing rights did not mean that the government has to build houses for the entire population and it especially does not mean that houses would be provided free of charge.

The level of unemployment which leads to poverty is very high in the whole country. Previously the construction industry through the Bantu Building Workers act of 1951 had legalized the training of blacks in the construction industry but limited the places they could work. According to the Countrystudies.us (1994) approximately 87.4% of the 40 400 000.00 South African citizens were not gainfully employed. MacMillan (2004) defines unemployment as a situation where people who are able to work are unemployed.

Stats Sa (2011) calculates the unemployment rate as the proportion of the labour force that was not employed and the labour force comprises of all the persons who are employed plus the unemployed. The unemployed rate for South Africa in the first quarter of 2011 was 25%. Gauteng Province (One of the 9 provinces in country were this study was conducted) had an unemployment rate of 26.9% which was higher than both the national unemployment rate. Other provinces with similar economic activities such as Kwa Zulu Natal and the Western Cape had lower unemployment rates of 20.3% and 22.2% respectively. Bendix (2001) blames this on the lack of labour based construction methods in the industry as it contributes to the loss of jobs without creating any.

According to Stats Sa (2010) the construction industry lost 45 000 jobs from the third quarter of 2010 to the first quarter of 2011. More specifically Gauteng as during this same period it recorded a loss of 24 000 jobs in the construction industry alone. Labour-intensive as defined by Founters (2006) is "the use of both machinery in the process but predominantly labour, without compromising the quality of the end product." McCutcheon (1995; p 332) defines it as "the effective substitution of equipment for labour" and this results in job creation in the industry. Further on McCutcheon (2003: p 151) writes that labour-intensive methods of construction does aim at achieving a significant (300 to 700 percent) increase in employment in comparison to machine intensive methods.

A comparison between Labour-Intensive and Equipment-Intensive construction methods

Labour-intensive methods of work will increase employment by percentages ranging from 300% to 600 % Thwala,(2006). According to Fountas (2006), the construction industry creates a large amount of employment, and specifically states that the use of labour intensive construction methods will increase employment. The adoption of labour-intensive construction methods for local projects ensures that finances remain within the country as opposed to money leaving the country in cases where equipment-intensive methods are prevalent, thereby increasing South Africa's GDP (Fountas:2006).Today labour-intensive construction methods can compete with equipment-intensive methods both technically and financially with a good productivity if managed correctly (Ntja,1999). One can ensure strong productivity and outcomes in labour-intensive methods by ensuring that good management is present on site (Ntja, 1990).

In developed countries machinery is easily available where labour is in short supply and expensive, in contrast to developing countries, such as South Africa, where labour is abundant and machinery is scarce and expensive (Ntja,1999). With similar cost and time frames, labour-intensive construction methods could potentially produce the exact same quality as equipment-intensive construction methods would, and in some cases, even better quality (Fitchett, 2009). Fitchett (2009), also suggest that the predominant use of labour-intensive construction methods could generate up to seven times more employment than a predominantly equipment-intensive project, without jeopardizing the budget. According to McCutcheon (2008), "for labour-intensive work to be successful and a better option compared to equipment-intensive work the following need to be achieved **(**McCutcheon, 2008):

- *The construction project needs to be treated as a proper engineering project, and careful consideration needs to be given to the social and economic factors of employment*
- *The labourers must be able to perform the tasks without harming themselves*
- *A detailed technical analysis of the project must be performed*
- *The specification, design and tender procedure must be appropriate*
- *Labour used for the project should be productive labour*
- *Work should be allocated individually to the different labourers for their different tasks*
- *Planning and preparation for the project should be done for the optimal sequence of operations, various activities for each operation and which individual group of labourers will perform these acts. Team balancing of the entire project must be incorporated.*
- *Employment contracts should be appropriate and, employees should only pay for work done.*
- *Employers/labourers should arrange their own transport*
- *The appropriate tools for specific operations should be used carefully and maintained*
- *Site supervisors must be well trained and qualified to hands on advice and training to the labourers*
- *Labourers must be open to orders from the site supervisors and there must be a good relationship between the site supervisor and labourers of the specific projects.*

- *There must be a link between the local community and the site work*
- *The site needs to be organized*.

Design Framework

In this research, one sample site was analysed. The main criteria that were looked at when choosing a sample was as follows:

- The site had to be government subsidized or funded low-cost housing development
- The site had to be located in the Gauteng area
- The site had to incorporate elements of labour-intensive and equipment-intensive construction.

In this study a High-Density location Tshepiso low-cost housing development was used as a case study. The Global Housing Foundation, (2010) defined adequate housing as that which satisfies the need for basic services; such as water supply, drainage and electricity as well as sufficient security, privacy and environmental quality . The Department of Human Settlement has implemented the RDP housing programme in this area. The houses are approximately 40square metres; it consists of 2 bedrooms, a separate bathroom, a kitchen and a lounge.

With this development which is wholly funded by the government employment creation would applied in order to address poverty in the community to build the sand houses and impart skills to the labourers. The Construction Industrial development Board (CIDB) 2011 reported that according to the National Housing Forum 1994 employment opportunities in the construction of housing and infrastructure are dependent on the construction methods employed. Therefore in a developing country like South Africa where unemployment is rife labour-intensive construction methods would contribute positively towards the economy better that the equipment –intensive method of construction.

The population in Tshepiso was identified as relevant to this research as it was still at its developmental stage. An observation approach was used initially to collect the basic information on the availability of the facts and details for this study. Still using the qualitative research method instruments were designed in the form of questioners and interview schedules. These where meant to understand the workings of the area through the data collected. The interviews did target the contractors and government officials in various responsible offices of the Department of Human Settlement and Public Housing. Most of the questioners where designed for the labourers to give their input on their understanding of labour- intensive versus machine-intensive and how these can be implemented. It was ascertained that most of the contractors hired most of their labourers from the surrounding areas and communities, these where mostly from the nearby Soweto Townships.

DISCUSSION AND FINDINGS

The Tshepiso low-cost housing development is a project subsidised by the South African government. It is situated in the Emfuleni municipality, more specifically Tshepiso North Extension 4, on Boy Louw Street. The project surroundings are inclusive of both industrial and residential elements. The project commenced the initial phase of construction in March 2011. During the conduction of this research a total of 1000 housing units had been built. However 3500 housing units were due to be built. The initial phase of the Tshepiso North Extension 4 housing development construction is due for completion in December 2011.

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The type of labour employed varied largely, in that, both women and men of all ages were given work opportunities, and the ages of labour ranged widely as well. The population consisted of 500 individuals, as this was the number of labourers employed on the entire site. From the 500 labourers, 7% were selected as respondents to the questionnaires designed specifically for the labourers on the sample site. In the context of this research, labourers were defined as targeted labour (McCutcheon, 1989). According to McCutcheon (1989), targeted labour can be defined as labour that is hired locally. The labourers were broken down into drivers, general and skilled labour. A total of 35 questionnaires were handed out to respondents on site, of which only 29 were useable, the remaining 6 questionnaires were not completely filled out and therefore considered "spoiled". Questionnaires were handed out with the help of the health and safety inspector to labourers working in excavations, concrete, masonry work, plastering, beam filling, bag washing and roofing. The following area by area observations were recorded.

Site clearance
Labour was employed as an alternative to machinery, compaction of the soil would take up to 15 times longer however, it would not be of the same standard. Also replacing one skilled labourer with one general labour does not create more employment.

Excavations
Both labour and machinery were used for excavation of the trenches. The total cost of each trench to be dug was R200, took one hour using a ditch- witch and employed three labourers. A ditch witch can be replaced by labour. The analysis regarding labour as an alternative to machinery in terms of time and cost feasibility will be done using information gathered from the data collected as well as the literature.

Concrete
It was established that ready-mix concrete was used. The cost of the ready-mix inclusive of delivery was R1200.00/.Four labourers were employed. One skilled labourer to assist in pouring the concrete as well as to supervise the pouring, two general labourers to assist in placing the concrete and one skilled labourer to compact the concrete with a poker vibrator. However, replacing ready-mix concrete with hand-mixed concrete may potentially provide additional labour. The analysis regarding labour as an alternative to machinery for mixing concrete in terms of time and cost feasibility will be done using information gathered from the data collected as well as the literature.

Brickwork
Brickwork utilised only labour.2 general labourers and 2 skilled labourers were employed for bricklaying. No machinery was implemented in this part of construction, and therefore an analysis to employ more labour will not be carried out.

Beam filling, Plastering and Bag wash
For beam filling, plastering and bag washing only labour was used. From informal interviews and observation it was gathered that no additional labour could be employed.

Finishes: removal of rubble/clearing of site

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The removal of the rubble on site employed only machinery, for which one driver was required. From informal interviews with the contractor, it was gathered that additional labour could be employed by replacing machinery with labour. From the informal interviews the contractor stated that if only labour were to be used, two general labourers would have to make approximately 12 round trips per unit using wheel barrows to remove the rubble. Each round trip would take approximately 5minutes.

Questionnaire Responses

The number of personal questionnaires handed out depended largely on the willingness of the labourers to participate. Certain individuals opted out of being a part of this research because they were not South African citizens, and were afraid of deportation. All in all a number of 35 personal questionnaires were handed out to respondents on the Tshepiso Sample site. However, only 29 of the 35 personal questionnaires could be used, as the remaining 6 were "spoiled", as they were incomplete. There was therefore a response rate of 83%, which is regarded as an excellent rate of response. To overcome the language barrier, the health and safety professional assisted in translating and interpreting questions to respondents who experienced problems while answering the personal questionnaires. To assist in analysing the quantitative data obtained from the personal questionnaires pie charts will be used. A pie chart is an effective way to analyse quantitative data (Kent, 2001).

Data Analysis

The pie chart is a useful method in comparing categorical data with up to five different categories (Peck, Olsen, Devore, 2008). A pie chart takes the form of a circle, which is cut into 'slices', each representing a certain category (Peck et. al., 2008). According to Kent (2001), a pie chart, as opposed to a bar chart, for the analysis of data is effective as it clearly shows that the sum of all the slices adds up to 100%. Pie charts, for the analysis of research data are also aesthetically pleasing (Kent, 2001). This is the method that was adopted for this study to give a true summary on responses to each question.

CONCLUSION AND RECOMMENDATIONS

This research has shown that there is room for further employment in government housing developments. In light of the three areas of the construction process of the specific development which implemented elements of equipment-intensive construction namely; earthworks, concrete and the clearing of the site , it was found that it is indeed possible to employ more manpower, thereby employing the element of labour-intensive construction, which in turn would create further employment in the construction industry.

To further break it down, in earthworks, abolishing equipment-intensive methods completely for labour-intensive methods, would require three more labourers at a cost which was R88.40/unit less than when equipment was utilised. The use of labour over equipment in this area of construction would mean that the process of excavations per unit would only take twenty minutes longer. With a relatively good decrease in cost and minute increase in duration it would be feasible to replace equipment with labour, thereby creating jobs for three more labourers per unit.

In placing and mixing the concrete, it was found that replacing machinery with labour completely would create work for 12 labourers, which is 8 more than with ready-mixed concrete. Employing a hundred percent labour-intensive methods would cost only R357.09/unit less than equipment-intensive methods. The use of labour-intensive methods in placing and mixing the concrete would take approximately 26 times longer than with equipment-intensive methods. Employment however, would be created work for eight more labourers per unit.

In the clearing of the site, it was found that the implementation of labour-intensive methods of construction over and above equipment-intensive construction would employ two labourers, which is one more than with the use of equipment. In terms of cost, using labour over machinery would only cost R8.68/unit more than with machinery. In terms of duration, clearing the site using labour-intensive methods will take 15 minutes/unit longer than with equipment-intensive methods. Employment however, will be created for one more labourer per unit. Therefore, since 3500 units are intended to be built on the Tshepiso sample site, the 12 jobs created per unit will increase employment significantly. Even though cost decreases were diminutive in terms of earthworks and concrete, it must be noted that in the construction industry even the smallest of costs can make a difference. In the clearing of rubble employing additional labour-intensive construction did in fact prove an increase in costs by a small fraction. However it must be stressed that feasibility in terms of time was not a primary consideration of this research. The replacement of equipment-intensive construction method with labour-intensive construction resulted in longer durations in carrying out the three areas of analysis. Time however, was also not a primary consideration of this research.

The primary aim of this research was to identify the areas of the construction process of a low-cost housing government development where additional labour-intensive methods of construction could be implemented so that employment could be created, which in turn would assist in decreasing the national unemployment rate. As a result of this research it was found that there is room for the further implementation of labour-intensive construction methods on government funded or subsidised low-cost housing developments, which would ideally result in employment creation.

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THE GUINNESS PARTNERSHIP LOW CARBON OFFICE RETROFIT PROGRAMME

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ABSTRACT

The office sector was responsible for 9% of the final energy consumption in the UK in 2011, however previous research has indicated that this sector has been slow to adopt energy efficient office features. This indicates that this sector presents significant opportunities for improvement. The Guinness Partnership has embarked on a two-year Knowledge Transfer Project (KTP) worth in total £125,372, that involves eco retro-fitting its offices to reduce the carbon footprint of its building portfolio and produce financial benefits. For the year of 2011, total gas consumption for its offices was 1,230,776 kWh and total electricity consumption was 3,192,206 with total CO_2 emissions of 1,963,023 kg. External benchmarking of the office stock using CIBSE 2008 data, highlighted that between 62-63% of its stock consumed more energy in comparison to their bench marks. Four offices were selected to carry out phase one retrofit. Post occupancy evaluation carried out on these offices concluded that that thermal comfort was an issue at certain times of the day and that. that occupants felt that they had a lack of control over their thermal comfort and lighting levels.

Keywords: Carbon emissions, energy audit, energy benchmarking, office buildings, post occupancy evaluation.

INTRODUCTION

The Guinness Partnership is one of the largest housing and care organisations in the country, owning and managing over 60,000 homes throughout England providing quality housing for people on low incomes. As part of their sustainability strategy, the charity wished to achieve a step-change in the carbon footprint of their property portfolio, reducing the demand for heat and electricity through energy efficient improvements to homes and estates. A two-year Knowledge Transfer Project (KTP) worth in total £125,372, commenced in November 2011 and initially involves eco retro-fitting Guinness offices to deliver environmental and financial benefits.

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However, the long term goal of the project is to develop an eco-retrofit capability, which can be rolled out to the Partnership's residential homes.

The energy consumption of the service sector in the UK for 2010 was 18,357 thousand tonnes of oil equivalent, which accounted for 12% of the final energy consumption. Commercial offices were responsible for 9% of this figure (National Statistics 2011). This highlights that offices, which make up a proportion of the service sector are a significant user of energy and emitter of CO_2 emissions. It has been argued that a lot of the energy efficiency programmes have been aimed at the domestic and industrial sector leaving office buildings overlooked (Scrase 2000). However, the energy use statistics indicate that considerable improvement has been made in the reduction of energy use in the services sector. During the period of 1990 to 2009 there was a drop in energy consumption in the service sector of 1.1 million tonnes of oil equivalent, however in real terms if energy efficiency had remained at the 1990 level this figure should have been 67% higher, therefore the reduction represents a significant improvement in energy consumption in this sector (National Statistics 2011). Despite this improvement, there has still been a slow uptake of energy efficient office features (Pellergrini-Masini and Leishman 2011), this may be linked to the fact that for many companies energy cost only presents a small proportion of the total business costs and so is overlooked or seen as a not a priority (Wade, et al. 2003). Consequently this sector still offers significant opportunity for energy savings and proposing energy efficiency intervention measures can be less complex compared to other sub sections of the service sector such as warehouses or retail, due to the energy consumption pattern in office buildings, which exhibits little variance from office to office (Wade, et al. 2003). In general, the largest proportion of energy use in the service sector by end use is heating, which accounts for 45% of the energy used, hot water 9% and lighting, which makes up 21% of the end use energy consumption (National Statistics 2011).

GUINNESS CARBON FOOTPRINT

The Guinness partnership has a total of 38 offices that it owns and leases with a large majority of its offices expected to be performing well below optimum levels, prior to commencement of the KTP programme detailed carbon assessment of its office portfolio had not been carried out. It is essential that energy and carbon dioxide emissions from its office portfolio was established to serve as a datum from which any energy and CO_2 emissions savings could be measured. For the year of 2011, total gas consumption was 1,230,776 kWh and total electricity consumption was 3,192,206, and associated CO_2 emissions of 226,463 kg and 1,736,560 kg respectively as shown in Figure 1 below. It would be expected that the gas consumption of The Guinness Partnership's office stock would be greater than the electricity consumption as the majority of energy consumed in an office building is due to space heating and hot water as previously stated. However, 53% of the Partnership's office stock uses electric space heating, whilst many of the offices that use gas boilers to provide space heating, still use electricity to generate hot water. The Guinness Partnership also has in-house IT services with the Partnership's largest office housing a server room, which contributes over 1 million kWh per annum to the electricity consumption.

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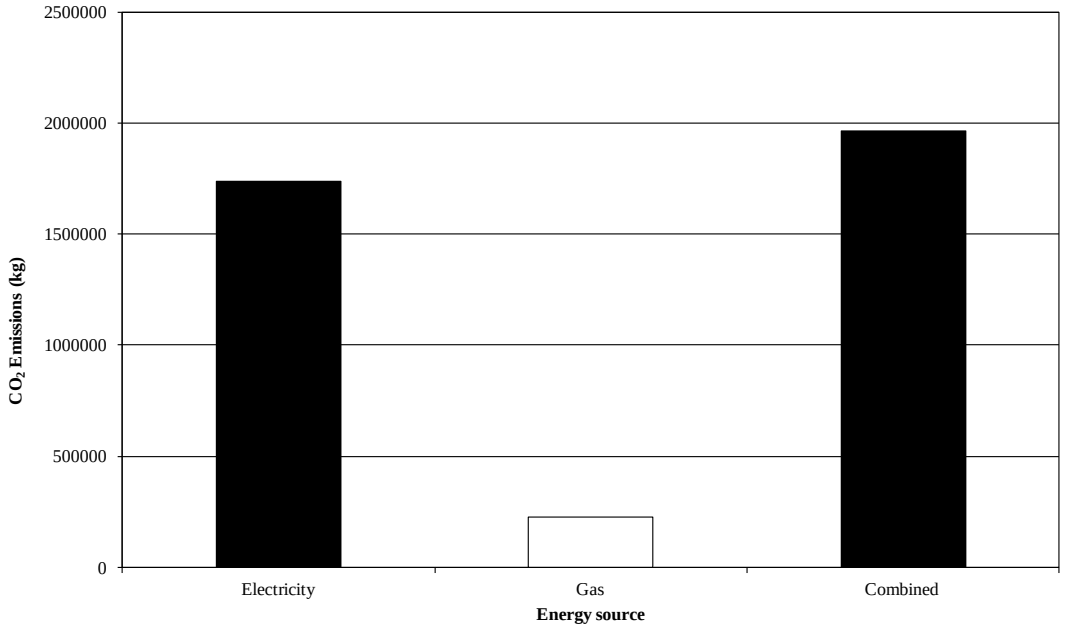

Figure 1 Histogram to show total annual CO_2 emissions of the Guinness Partnership office stock

Office stock type

The condition and construction type of the Partnership's offices is highly variable preventing a one-size-fits-all approach to eco-retrofit. Furthermore the stock portfolio contains some difficult to treat buildings including those constructed with solid masonry building fabric. It was the one of the aims of this project to select different building typologies and tenures in order to learn from the eco retrofit process and to apply this when it comes to the full roll out of eco retrofit to whole of the office stock. Analysis of the office stock highlighted that 64% of its office buildings were owned and 36% leased. Leasehold buildings pose some challenges due to the structure of commercial leases (Wade, et al. 2003), although some leases such as full repair and refurbish leases offer the flexibility of tenants to instigate interventions as they deem fit. The remaining duration of the lease is a key factor in selecting interventions measures and ensuring payback periods fall within the duration of the lease.

The performance of buildings is influenced by many factors some of which include the efficiency of installed space heating systems, climatic conditions and the building fabric (BPIE 2011). Of these the building fabric and age of construction has a major impact on energy performance. The whole of the Guinness office portfolio was categorised in terms of construction date and the results of this analysis is shown in Figure 2 below.

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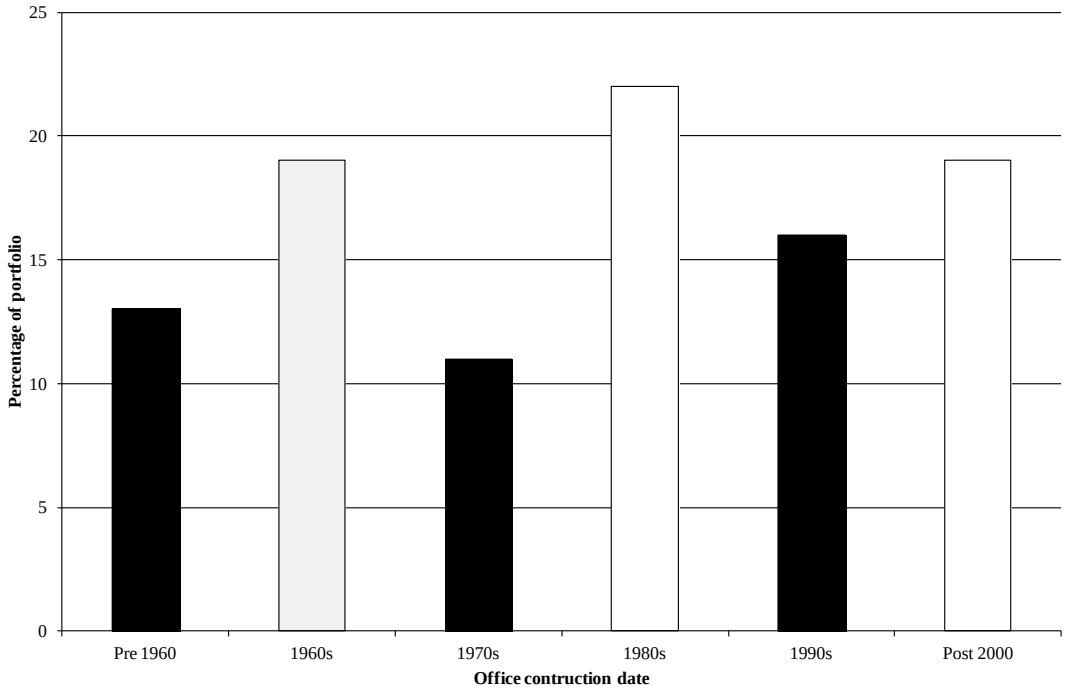

Figure 2 Histogram to show office proportion by date of construction

The date of construction is a reflection of the Building Regulations that were in place at the time and the thermal performance of the fabric required to comply with the regulations at that point in time. The Building Regulations did not come into force before 1966 and 1985 saw the switch over to the more modern system of Building Regulations and Part L2 Conservation of Fuel and Power in buildings other than dwellings. Analysis of the office stock indicated that 43% of the portfolio was constructed prior to 1985 with thirteen percent of the office stock being constructed pre 1960s and these may be defined as "difficult to treat buildings". BRE (2008) define a hard to treat building as one "for whatever reason, cannot accommodate staple, or cost effective fabric energy efficiency measures". It is clear that the portfolio presented some challenges but also great potential for improvement.

BENCHMARKING

An internal and external benchmarking exercise was carried out on the office portfolio as these can be used in order to identify buildings that need closer scrutiny or to highlight problem areas in buildings (BRECSU 2000) The offices were ranked in order of energy consumption per m^2 (GIA) for both electricity and gas consumption. As the phase one pilot scheme is aimed to produce the greatest insight into the rollout of retrofit across the whole of the office stock, it was important to select offices of varying performance. This will help to produce a business case for implementing energy efficiency improvements to all offices rather than only the offices that are performing poorly. Energy benchmarks were taken from CIBSE (2008) and used to compare The Guinness Partnership offices to a 'typical office'. Analysis of the benchmarking data highlighted that 62% of The Guinness Partnership's offices consumed more electricity per m^2 annually than a 'typical office' whilst of the offices that have a gas supply 63% consumed more than a 'typical office'.

OFFICE SELECTION

The phase one of the office retrofit programme involved the selection of four offices, which were capable of delivering significant energy/cost savings whilst ensuring that they represent a broad spread of building types. The programme was divided into two phases so that lessons learnt during phase one could be applied to phase two with the documentation of the process and development of training materials that will be used to embed the eco retrofit capability within the organisation.

The following selection criteria was formulated: a range of performance according to the benchmarking exercise, minimum occupancy of 20, variety of building typologies, no conservation areas, variety of office tenures, avoidance of recently refurbished offices, priority towards offices due to undergo refurbishment. The four offices selected and their attributes are shown in Table 1. In terms of benchmarking, it can be seen from Table 1 that in terms of electricity two of the offices's energy consumption were almost three times that of the appropriate benchmark. In terms of Bower House, this can be attributed to housing the servers for the whole of the Guinness Partnership. Henshaw House's high electricity use is attributed to the fact that its space heating is provided by electricity. All of the offices gas consumption were far higher than the benchmark some more than double. In terms of benchmark CO_2 emissions all of the offices emit higher emissions when compared to the benchmark which is expected for Bower House and Henshaw house due to their high electricity use and the carbon density figure of electricity of 0.544 kg CO_2e/kWh (AEA 2010) which is far higher than the figure for gas of 0.184 kg CO_2e/kWh (AEA 2010).

	Bower House	**Henshaw House**	**Havant**	**High Wycombe**
Annual Energy Costs (2011)	£169,132	£29,775	£14,292	£15,613
Electricity consumption per m^2 (2011)	307kWh	291kWh	122kWh	103kWh
Benchmark electricity consumption per m^2 (2011)	95	95	95	95
Gas consumption per m^2 (2011)	53kWh	n/a	215kWh	201kWh
Benchmark gas consumption per m^2	120	n/a	120	120
Kg CO_2 per m^2 (2011)	177kg	162kg	110kg	93kg
Benchmark Kg CO_2 per m^2	75	75	75	75
Gross Internal Floor Area (m^2)	5097	980	653	1077
Number of Colleagues	334	83	73	90
Construction Type	Brick Cavity	Concrete Framed, Floor to ceiling glazing	Concrete frame – Brick outer skin	Brick Cavity
Approximate Construction Date	2005	1960's	1964	1990

Table 1 Phase one office selection

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POST OCCUPANCY ANALYSIS

Post occupancy evaluation (POE) is often associated with new buildings however POE can be also refer to a general term for any exercise that seeks to obtain feedback on the performance of an occupied building (Jaunzens, et al. 2003). It was deemed essential to try to understand how the users view the performance of the building to gain a better understanding of how the building is currently performing and how energy is used, before proposing any intervention measures. Occupant behaviour and activities are a major influence on the total energy consumption of a building (Yu, et al. 2011). The occupants of all of the Phase One offices received an electronic questionnaire via Survey Monkey. Some of the key findings can be found in Table two.

	Bower House	Henshaw House	Havant	High Wycombe
How would you rate thermal comfort in the summer between 08.00 - 12.00 1 = very cold 5 = very hot (Overall Score)	3	3	3	3
How would you rate thermal comfort in the summer between 12.00 - 17.00 1 = very cold 5 = very hot (Overall Score)	3	4	4	4
How would you rate thermal comfort in the winter between 08.00 - 12.00 winter 1 = very cold 5 = very hot (Overall Score)	3	3	3	3
How would you rate thermal comfort in the winterbetween 12.00 - 17.00 1 = very cold 5 = very hot (Overall Score)	3	2	3	3
How much control do you feel you have over your thermal comfort 1 = none 5 = total control (Overall Score)	1	1	2	3
How do you rate the quality of the lighting at your desk 1 = very poor 5 = very good (Overall Score)	4	3	4	4
How do you rate the level of lighting control at your desk 1 = very poor 5 = very good (Overall Score)	1	1	3	1
How would you rate the level of natural light 1 = very poor 5 = very good (Overall Score)	5	5	5	4
How would you rate the quality of air in your office 1 = very poor 5 = very good (Overall Score)	3	1	3	2
How would you rate the amount of control you have over the air quality 1 = very poor 5 = very good (Overall Score)	1	1	2	3

Table 2 Summary of post occupancy analysis results

Some of the parameters that influence occupant satisfaction with their environment are; thermal, visual and acoustic conditions (CIBSE 2007) and a major focus of the questionnaire was establishing how the occupants rated their current thermal environment. It is widely established that thermal comfort is subjective and that the best you can realistically aim to achieve is a thermal environment that satisfies a majority of the occupants (HSE 1999). Analysing the findings of the survey three of the offices reported that the thermal comfort rating in the summer between 12.00-17.00 was hot. This could be an indication of unwanted solar gain, that the thermal mass of the building had reached its full storage capacity and so the temperature within the internal space had started to rise or that heat emitting devices such as printers or photocopies are in close proximity to occupied spaces. In view of this information intervention strategies that may be considered could be the installation of

solar shading devices, the use of natural or mechanical ventilation, the use of night time cooling or moving heat emitting equipment to well ventilated areas of the building preferably on the North elevation of the building (Carbon Trust 2010). When the occupants were asked what they would do if the temperature were too high the responses ranged from opening a window, changing the air conditioning settings or using a desk fan, which was a popular answer and increases the summer time electricity consumption. The control over the thermal comfort was cited as none by two of the offices and whilst this reflected in one of the offices poor rating of thermal comfort the other office was air conditioned and the thermal comfort rating was neither hot or cold. A perceived or actual lack of control was common theme in the questionnaire responses with three of the offices stating that there was no control over the level of lighting at their desk and three of the offices stating that they had none or little control over the air quality in the offices. A lack of control over the lighting levels can result in an occupied space being overlit at some times of the day resulting in wasted energy. The lack of control over the air quality in one of the buildings can be attributed to the fact that it is air conditioned and is also linked to the feedback about no control over the thermal comfort. The provision of control is sometimes at odds with the goal of energy conservation with some authors claiming that occupants are the weakest link any energy conservation drive (Masoso and Grobler 2010). However, it has also been argued that if occupants are able to adapt their internal environment to suit their own requirements then they are less likely to suffer discomfort (Nicol and Humphreys 2002). Furthermore, there is a correlation between lack of control over the environment and occupant intolerance of discomfort (Scrase 2000).

FUTURE WORK

A measured survey and energy audit will be carried out on each Phase 1 offices. The energy audits will be used in conjunction with the POE to analyse energy consumption and propose energy interventions. The measured survey data will be used to build a model of the offices in the thermal simulation programme IES. This software will be used to quantify energy savings from any proposed interventions and to build a business case to fund the work.

CONCLUSION

Energy reduction measures have been largely overlooked in the service sector due to issues including tenure and the fact the energy consumption in terms of overall costs is only a small proportion of total costs. However, commercial offices account for 9% of final energy consumption in the UK and so it can be seen that this sector still offers significant potential for improvement. The current KTP project aims to reduce the energy use and carbon emissions from the Guinness Partnership's offices and in doing so reduce the carbon footprint and running costs of the Trust's office stock, delivering cost savings to the Trust. Furthermore, the successful conclusion of this project will build upon The Guinness Partnership's reputation for genuine environmental credentials and adhere to the Guinness Partnership's ambitious sustainability policy.

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A TOTAL MANAGEMENT STRATEGY FOR CONTROL OF LAND USE IN HONG KONG

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ABSTRACT

Illegal change of use in aged industrial and residential buildings is now a problem in Hong Kong. This research aims to develop a management strategy for an effective control of land use in a highly dense environment. Multiple cases were qualitatively analyzed, based on documentary analysis of the court proceedings. In Cases 1 and 2, land lease conditions for restriction to industrial purposes in aged industrial buildings were found to be obsolete and not economically viable, thus resulting in illegal conversion of the premises for commercial use. Cases 2 and 3 showed that ambiguity in user clauses in land leases could lead to illegal change of use from industrial or residential to commercial activities. Most importantly, Cases 1 and 3 demonstrated that tight resources for lease enforcement are the fundamental cause of the problem. Cases 4 and 5 proved and inferred that property managers could effectively take legal action against change of use in high rise buildings with multiple ownerships. A total management strategy should be adopted. The government land management system should work in partnership with private property managers which are empowered under the Deed of Mutual Covenant (DMC) of multiple occupied buildings to take instant action against individual owners for breach of lease conditions. The system should also allow lease modifications, as well as review and clarify any ambiguous user clauses.

Keywords: change of land lease conditions, highly dense environment, land and property management

INTRODUCTION

Land is a scare resource so it is important to have an effective management system to make sure that the land is used according to the statutory planning and land grant conditions, and that allocated land uses can be maintained at an optimum level (Nissim, 1998).

All lands in Hong Kong are virtually held under leasehold tenures. Leasehold tenures are granted by the Lands Department in three ways: public auction, tender or private treaty

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grant. Land is granted to the lessee (land owner) by the lessor (government) and the lease conditions, either by deed and conditions of sale/grant/re-grant/extension, regulate the lessee in respect of the land use. Once irregularities are detected by the Lands Department through public complaint or departmental referral, a series of lease enforcement action would be taken by the Department. The Lands Department (2011a) clearly indicates that the Department has a mission to strive to achieve excellence in land administration and optimum land use for the greater benefit of the community. According to its 2010/11 performance pledges, one of the visions is to ensure an effective enforcement of land use. To this end, all District Lands Offices have lease enforcement teams to inspect premises upon complaints on a breach of lease conditions (Wong, 1998). Actions include registration of the warning letters at the Land Registry, commonly known as "imposing an encumbrance", or pursue legal action against the lessee.

Despite of this, breaches of lease conditions are still a common problem in Hong Kong. There have been many conflicts between the Lands Department and lessees arising from enforcement of lease conditions. A number of cases have ended up in court (Nissim, 1998). For example, some lessees have changed industrial premises into flats, or even converted residential premises into retail shops. Illegal sub-division of flats into smaller units is now a common problem, which affects building safety and has drawn a lot of public attention, as shown in a tragic fire which broke out in an 8-story building in 2011 resulting in several casualties (Ho, 2011).

How should the lease enforcement system be improved for an effective control of illegal land use in occupied premises? A review of recent literature review indicates that previous research has mainly focused on the impact of land lease conditions on property values, and there is a lack of research on the lease enforcement system in Hong Kong. This research therefore aims to develop a management strategy for an effective control of land use in a highly dense built environment, with high rise buildings in multiple ownerships. Such a strategy will address the key issues causing lease enforcement problems from a management perspective.

LITERATURE REVIEW

Economic Issue

The Lands Department enforces lease conditions pursuant to the user clauses in Crown Leases and New Grants which could be executed more than 50 or even 100 years ago, when the built environment, town planning requirements, building regulations and demography were completely different from today. Lai, *et al.* (2010) point out that illegal change of land use in obsolete industry buildings is an inevitable problem and this complicated issue needs to be resolved.

The most common form of contravention of lease conditions in industrial premises is a breach of the 'industrial purposes' restriction. As most of the lessees of the industrial buildings take the advantage of the incentives such as low labour wages, low land rent and tax concessions allowed by the 'Open Door Policy' of China, their industrial activities have been relocated to Mainland China since the early 1980s. Consequently, many industrial buildings governed by industrial leases have been left vacant. Illegal changes in the use of

these premises for other purposes such as stores, band rooms and residential units have gradually become a common phenomenon since the 1980s.

This problem has been seriously criticized by the local media. As reported by Ming Pao Daily (2011a) and (2011b), an industrial building in the deprived Tai Kok Tsui district was built in the 1950s without lift installation and subject to dilapidation. The rental value of recently developed industrial buildings in the locality was only seven to eight dollars per square foot, so many aged industrial buildings had been left vacant. The vacancy rate of industrial buildings was 8% in 2009, according to the Hong Kong Property Review 2010 (Rating and Valuation Department, 2010). Lessees tend to partition factory premises into residential units to get a higher rental income. Surprisingly, the 4th floor, 5th floor and roof of this industrial building had been partitioned into nearly 30 residential units. Many low-income groups cannot afford the high rents in the housing market, and have no option but to live in a poor condition. The Society for Community Organization alleged that many industrial buildings in deprived areas have been illegally changed into residential use.

The media reports clearly indicate that the conversion of aged industrial premises into residential use is a serious problem due to the fact that the lease restriction to 'industry purposes' has become obsolete. Wisegeek (2011) contends that the fundamental objectives of business organizations are to ensure that their available resources can be utilized to the greatest advantage for long-term profits and that the community where the business is located would benefit. Aged industrial buildings are simply not economically sustainable. Clearly the illegal change of lease conditions is not acceptable. A long-term solution should be considered to allow lease modification so that redevelopment can be undertaken to accommodate new uses by owners or developers. The premium for a lease modification is assessed by the Lands Department on the basis of the enhancement in land value as a result of the modification (Lands Department, 2011d). However, the top-up premium nowadays could be unaffordable because of the high land prices in Hong Kong. Using an econometric model of residential property prices in Hong Kong, Craig and Hua (2011) find that the high prices are driven by limited land supply, coupled with rapid rise in real GDP and domestic credit growth as well as the recent negative real interest rate. This means that unless the government is flexible in the assessment of the premium, it can be unaffordable, hindering change of use of premises or redevelopment.

Resources Issue

As reported by Oriental Daily News (2009), an industrial building at Bedford Road had been converted for residential use. In 2007, the Lands Department discovered that this building had been changed for residential use but no further lease enforcement action was taken. After two years, that is, in 2009, no improvement had been made and the extent of the illegal change of use became even worse. The third floor had been partitioned into twenty units with a communal living area, kitchen and lavatory. A councilor of district council pointed out that the conversion of vacant industrial buildings into residential units was a serious problem, but unfortunately the Lands Department did not have enough resources to tackle it.

In response to a query on insufficient resources for lease enforcement, it was reported by the Lands Department (2011b) that the number of lease enforcement cases tackled over the

last three years was 891 in 2009, 904 in 2010, and 900 in 2011. The number of cases handled was relatively constant due tight staff resources. To strengthen its efforts, the Department focused on the more complicated cases in 2011/12. According to Lands Department (2011c), the estimated expenditure for land control and lease enforcement was HK$100.5 million in 2011/12, with around 250 staff. With this substantial expenditure for land management, there is no doubt that the government intends to restrain from further increase in resources.

In the highly dense environment in Hong Kong, high-rise residential, commercial and industrial buildings are primarily sub-divided into multiple ownerships, with property managers being appointed by the owners' corporation (OC) and responsible for managing both the common and the private parts, using the power under the 'Deed of Mutual Covenant' (DMC).

The OC is formed by all members of the building. Pursuant to Section 18(1) of the Building Management Ordinance (BMO), the OC has duties and power to manage and maintain the common parts of the building, and do all things reasonably necessary for the enforcement of the obligations contained in the DMC in respect of control, management and administration of the building (Home Affairs Department, 2011). The OC may appoint a property management company or other professional firms to assist in carrying out its duties. So the property manager, being an agent of the OC, has the legal power to discharge the duties of the OC, and such power is explicitly stated in the DMC.

According to HKIS (2008), the DMC is a private contractual agreement binding all the co-owners and its objective is to set out clear rules and restrictions that property owners, tenants and occupiers must follow in respect of using the common part, private areas and facilities of the development. It comes into effect on the date of execution by the developer and the purchaser of the first unit of the building and is binding on other subsequent purchasers. One of the covenants, as introduced by Legal Advisory and Conveyance Office (2006), is that all owners and the property manager must covenant each other to comply with the land grant conditions so long as they remain as owners or manager. This means that property managers now have the additional power to take action against individual owners for breach of lease conditions. Although the lease enforcement action is still primarily vested with the government (Lands Department, 2011a), this mechanism of allowing property managers to take legal action against illegal change of land use can be regarded as a second tier of management control to supplement the government's tight resources.

Other Issues

Besides, there are occasions where lessees, sometimes occupiers, are alleged to be in breach of lease conditions and when lease enforcement action is taken against them, they challenge the action in court, based on the ambiguity in lease conditions (Nissim, 1998).

In a press release to address the problem of sub-division of flats into smaller units for letting, the Hong Kong Institute of Surveyors advises that both the building management and housing policy should be considered to provide a long-term solution to eliminate illegal change of land use (Ho, 2011).

HYPOTHESES AND RESEARCH METHODOLOGY

The literature review indicates that the existing lease enforcement system should be improved. It was hypothesized that:

1. Lease restriction to 'industrial purposes' in aged industrial buildings has become obsolete. Such buildings are not economically sustainable to run, thus resulting in illegal change of use.
2. Government resources for lease enforcement are not sufficient.
3. Some lease conditions are ambiguous in defining the exact land use, thus resulting in difficulties in enforcement.
4. Government resources can be supplemented by property managers using the power granted under the DMC for control of land grant conditions.

This research focuses on the use of management measures to improve the existing lease enforcement system. The provision of more affordable housing for lower income group to tackle housing shortage and illegal change of premises to residential use is not covered by this study, and this should be treated as a separate issue for further research.

Owing to the fact that lease enforcement is a sensitive issue, a qualitative interview with the government officials would not be easy. A court clarification of the exact meaning of a land use is not uncommon when there is a conflict in opinion between the government and the land user (Lai *et al*, 2010). Hence, legal cases related to the change of lease conditions between the lessor (government) and the lessee (land user) can provide some insight and a gist of the reasons causing contravention, and indicate how such a problem can be rectified.

The multiple-case study method, based five typical cases, was used to qualitatively verify the hypotheses. These cases are related to the common breaches of land grant conditions in Hong Kong, including the change from industrial purposes to other uses (two cases), the change from residential use to other commercial activities (one case), along the impact of property management on the control of illegal land use in residential buildings (two cases). The use of typical cases to capture every day occurrences is one of the reasons for choosing the case study method (Yin, 2009). Proverbs and Gameson (2008) add that the findings of a typical case will be of relevance to many other similar projects. Fellows and Liu (2008) and Yin (2009) state that case study research can be used to investigate phenomena within a real context and can therefore draw rich conclusions.

A documentary analysis of court cases was deployed to collect qualitative data. Details of the cases were obtained from the Hong Kong Legal Information Institute (HKLII) which provides original information of court cases in Hong Kong with an aim to support and promote the legal system.

FINDINGS AND DISCUSSION

Case 1 (HKLII, 2003): Pak Wai Ching (Plaintiff) v The Secretary for Justice (Defendant) [2003] HKCFI 725

This is a typical case involving an illegal change of use of land from industrial to residential purposes. The plaintiff had owned a unit on the ground floor in an industrial

building since 1978. The land lot was governed by a condition of sale registered in the Land Registry in 1972. The Special Condition 2(a) requires that the premises should be used for either industrial or godown purposes or both.

The Lands Department received a complaint on the premises on 18 April 2000 and subsequently discovered that the premises were used for selling flowers and wreaths to patrons of and visitors to the Hong Kong funeral parlour. Since the flower shop constituted a commercial activity which contravened and breached the lease conditions, the Department issued a warning letter on 31 October 2000 to the plaintiff requesting that she ratify and remedy the breach.

After receiving the warning letter, the plaintiff contended that her use of the premises as a flower shop did not constitute a breach of the lease conditions because the government had waived the acquiescence to enforce the lease conditions for fifteen years since the acquisition of the premises in 1978. The Department had not taken any action until the contravention was first noticed in 1993. The plaintiff hoped that she could continue to use the premises as a flower shop without paying a waiver fee and a premium for lease modification.

As explained by the district estate surveyor, staff resources for lease enforcement were not sufficient, with less than ten staff since 1982. This limited number of staff serves not only Hong Kong East, but also Hong Kong West as well as Hong Kong South.

The court held that selling flowers and wreaths was considered as a commercial activity, which contravened the lease condition.

This case demonstrates a typical lease enforcement problem in Hong Kong. The Lands Department tried to enforce the lease condition registered in the Land Registry in 1972, which was more than thirty years ago. However, such restriction to 'industrial uses' have become obsolete, thus resulting in illegal changes of use. This is in coincidence with the findings of Lai *et al.* (2010). Hypothesis 1 is therefore validated. This case infers that lease conditions should be allowed to be modified to enable economic sustainability for business.

The Lands Department tried to enforce the lease condition after the original industrial use had been breached for 15 years. Apparently, enforcement resources were not sufficient so this validates Hypothesis 2.

Case 2 (HKLII, 2000): Raider Limited v The Secretary for Justice [2000] HKCFA 76
This case is also about change of use of an industrial building to other activity. The appellant (Raider Limited) had owned the premises on 22nd floor of a factory since 1994 and 1995. According to the Special Conditions 2(a) and 2(b) of the land lease dated 14 January 1963, the lessee of the lot was restricted to use the premises for 'industrial purposes' except for offensive trades producing pollutants, and for ancillary uses like offices and quarters for persons employed for building safety and security.

The appellant used the premises for the manufacture of pagers and the provision of a paging service. In 1995, the Lands Department conducted an inspection of the appellant's premises and discovered that the premises were used for providing paging services, which contravened and breached the lease conditions. The owner appealed against the Department's point of view by commencing litigation. His reason was that the use of the premises did not breach and had not breached the Special Condition 2(a) as the primary use of premises was and had at all times been for industrial purposes.

The Lands Department appealed to the Court of Appeal on 7 December 1999 against the previous court judgment which held that the appellant did not contravene and breach the restrictive 'industrial uses' stipulated in the Special Condition 2(a). The Department argued that the paging service provided by the appellant did in fact constitute a breach. The court upheld the appeal because the paging service could not be regarded as ancillary offices or quarters allowed by the Special Condition 2(b). Also, the provision of a paging service could not be perceived as the final process of the manufacturing industrial undertaking. The paging service was separated from the manufacturing of the pagers.

Again the Lands Department tried to enforce the lease conditions of the subject premises pursuant to the Conditions of Sale registered in the Land Registry in 1963, which was more than forty years ago. The restriction to 'industrial purposes' had become obsolete so the lessee changed the use of premises to providing a paging service which was more economically viable. This finding also validates Hypothesis 1.

The appellant alleged that the paging service was ancillary to the manufacturing of the pagers. The user clause of 'ancillary uses' creates an ambiguity and difficulties for the Lands Department to enforce the restrictive covenant in practice. This finding validates Hypothesis 3 and infers that an amendment should be made to The Land (Miscellaneous Provisions) Ordinance, Cap. 28 to clearly define what ancillary uses for industry buildings are in order to plug the loopholes for illegal changes of land use.

Case 3 (HKLII, 2007): Expressluck Development Limited and Best Partner Limited (Plaintiffs) v The Secretary for Justice (Defendant) [2007] HKCFI 755

The plaintiffs alleged that the ground floor of a domestic building could be used for shops or for other commercial purposes. The Lands Department contended that such uses would contravene and breach the Special Condition (c) in Conditions of Exchange No. 3996 registered in the Land Registry in July 1939, which stipulated that the lessee of the lot is restricted to using the land for domestic housing.

The plaintiffs commenced the litigation on the grounds that the restrictive covenant did not restrict the use of the ground floor for commercial purposes and that the plaintiff's ancestor had used the ground floor for a restaurant and other commercial uses since the 1940s. However, the Lands Department had not taken any lease enforcement actions previously so the plaintiff conceived that this waived the restrictive covenant in the lease conditions.

In 2003, the Lands Department confirmed that the plaintiffs' proposed residential redevelopment, with the ground floor used as a play area and gymnasium for the residents, was acceptable under the restrictive user covenant because the redevelopment would be

basically used for residential purposes. After the redevelopment was completed, the plaintiffs used the ground floor for a shop so the Department took legal action against them.

The plaintiffs contended that the use of the lot did not contravene the restrictive covenant. The restrictive covenant only restricted the type of building to be erected, but not on the use of the lot. Besides, the 20-storey formed a large portion of the domestic ration in the lot. The use therefore did not deviate from the lease condition. However, the court held that the plaintiffs could not use the ground floor as a shop because the whole building should be used for domestic use, not just a large portion.

This case shows that the ambiguity in lease conditions, that is, in the erection of domestic houses, provides loopholes for land users to change the land use. This finding confirms the validity of Hypothesis 3 that ambiguities in defining lease conditions does pose problems in land use and difficulties in enforcement.

The case also demonstrates that the government's enforcement resources are not adequate. The plaintiff argued that their ancestor had used the ground floor for a restaurant and commercial uses since the 1940s. In the 1980s, the plaintiffs at last did not regularize the use as a congee and noodle shop but no lease enforcement action had been taken since then. So the plaintiffs conceived that this waived the restrictive covenant. This finding validates Hypothesis 2 that government resources are not sufficient.

Case 4 (HKLII, 2010a): Goodwell Property Management Ltd (Plaintiff) v Ng Shung Kwok Dickson and Other (Defendant) [2010] HKDC 107
In this case, the plaintiff was the property manager of a residential development, whereas the defendants were the registered owners of Flat B on the ground floor and the adjacent flat roof adjacent to Tower 3. The plaintiff claimed for an injunctive relief against the defendants in respect to the structures erected on the property, based on the reason that this was in breach of the DMC of the estate.

Between October 2004 and September 2006, the defendants erected a canopy structure on the larger flat roof, and altered the entrance to the smaller flat roof by removing the gate and erecting a door-like structure. No written approval for undergoing the said renovations was given by the plaintiff at any time.

Clause 17 of the DMC provides "No owner shall do or permit to be done any act or thing which may or will alter the external appearance of the Estate or any part thereof" and Clause 25 reads "…… Without prejudice to any other provision in this Deed the Owner(s) for the time being of the flat roof(s) or the roof(s) of the Estate shall not erect, affix or install or cause or allow to be erected affixed or installed any structure on such flat roof(s) or the roof(s) save and except with the prior written approval of the Manager ……"

The defendant alleged that it was necessary for the canopies to be constructed for protecting people from being hit by objects falling from above. However, the court held that the defendants were bound by the provisions of the DMC so there was no defense for them to abate the incidents of falling objects from a height by breaching their own obligations under the DMC.

This case involved a change of roof spaces into an enclosed home. Although the case did not involve a material change of land use from one type to another, it does infer that if there is any breach of the DMC covenants, property managers can effectively take legal action against individual owners. As the Legal Advisory and Conveyance Office (2006) introduces a covenant to the DMC that all owners and the property manager must covenant each other to comply with land grant conditions, property managers now have the additional power to control illegal changes of land use. As such, property managers can supplement government resources for lease enforcement and this validates Hypothesis 4.

Case 5 (HKLII, 2010b): Central Management Ltd (Plaintiff) v Light Field Investment Ltd and Another (Defendant) [2010] HKCFI 22

The plaintiff, a property manager of a high rise residential building, took legal action to restrain the owners of two adjoining flats (defendants) from removing the structural parts of a partition wall between the two flats on 53rd floor.

The plaintiff successfully claimed that the structural wall was part of the common areas and facilities defined by the DMC, which "means and includes … low-bearing walls, foundations, columns, beams and other structural supports of the Development", and by the BMO, which refers to "the whole of a building, except such parts as have been specified or designated in an instrument registered in the Land Registry as being for the exclusive use, occupation or enjoyment of an owner".

The court also pointed out that Clause 37 of the DMC gave the power and obligation to the plaintiff to manage and keep in good order and repair all common areas and facilities.

Consequently, it was decided by the court that the structural part of the partition wall separating the two units unit was part of the common areas and facilities as defined in the DMC. An injunction was granted to restrain the defendants from removing, altering or making any opening in the structural part of the said partition wall.

All co-owners should follow the DMC covenants and property managers have the power to enforce such restrictions, as spelled out by the HKIS (2008) and the Home Affairs Department (2011). Again this case demonstrates that property managers can effectively take legal action against individual owners for illegal land use, using the DMC power and the related covenants. This validates Hypothesis 4.

Summary of Validation of Hypotheses

Cases 1 and 2 verified that lease conditions for restricting land use to 'industrial purposes' in aged industrial buildings had become obsolete, thus resulting in illegal changes of use to commercial activities (Hypothesis 1). Cases 2 and 3 showed that ambiguities in the user clauses of land leases could lead to illegal changes of use from industrial or residential purposes to commercial activities (Hypothesis 2). Most importantly, Cases 1 and 3 demonstrated that the lack of sufficient resources for an effective enforcement is a fundamental cause of the problem (Hypothesis 3). Cases 4 and 5 proved and inferred that property managers could effectively bring legal action against illegal land use in buildings with multiple ownerships, using the power under the DMC (Hypothesis 4).

CONCLUSIONS

The multiple-case study indicates that illegal changes of land use are a common problem in high rise buildings in Hong Kong. In aged industrial buildings, the typical change is from industrial to commercial or residential use. Residential buildings are often changed to commercial use on the ground floor and the rooftops are frequently changed to enclosed spaces. Government resources for lease enforcement in a highly dense environment are not sufficient, but property managers can effectively supplement them by controlling land use through the use of their power under the DMC.

The Legal Advisory and Conveyance Office (2006) introduces a restrictive covenant to the DMCs that all owners and the property manager must covenant each other to comply with the land grant conditions. As this only applies to the new DMCs created in and after 2006, it is recommended that the BMO should be amended so that the covenant is also applicable to the existing ones formed before 2006. Consequently, property managers can supplement government enforcement resources in all cases. The government should form a strategic partnership with private property managers, and encourage them to take instant action if necessary.

In addition to this, the land management system should be flexible to encourage and allow lease modifications from industrial to other uses by owners or developers, and the amount of premium required should be affordable. The system should also review and clarify any ambiguous user clauses through amendments of the related Land Ordinance.

A total management strategy should be adopted for an effective control of land use, comprising an enforcement partnership formed between the government and private property managers, flexibility in lease modification and clarification of ambiguous user clauses. The results of this study are derived from five typical cases, but they form a baseline upon which further research can build to test their significance in many other settings. Ultimately, a more robust management strategy can be developed for ensuring an effective control of land use.

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INFLUENCE OF LANDSCAPE CHARACTERISTICS OF THE LAGOS LAGOON ON URBAN TOURISM DEVELOPMENT

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ABSTRACT

The Lagos Lagoon is a major geographical feature in Lagos, being the largest of the network of lagoons that stretch from Republic of Benin through to the Nigerian Niger Delta. Parts of the lagoon waterfront have degenerated into slums, with mainly shanties at various points, wood preservation, markets and sand dredging activities, robbing the area of potential urban tourism revenue. Growing statistics indicate financial gains in exploiting water tourism. In recognition of this, the Lagos Government is pursuing an aggressive tourism and waterfront development strategy for Lagos Metropolis. To determine the place of landscape features of the Lagos Lagoon on its viability for tourism, the research evaluates the lagoon's landscape characteristics and answers questions of landscape perception of the area, identifying other factors which may be of relevance to its tourism development. Using structured questionnaires with pictures of the landscape features of the lagoon, field survey and interviews, the study identified the communities, problems, and factors influencing tourism development. Results show that the landscape characteristics of the lagoon have a very significant effect on tourism development. It identified the availability of beaches, nature of adjourning land-uses and proper planning of the area as major factors influencing its tourism development.

Keywords: Lagos lagoon, landscape assessment, landscape perception, urban tourism, water-based recreation.

INTRODUCTION

The place of tourism as an engine for growth and an economic driver has been much emphasized, especially in developing countries such as Nigeria and Ghana (Uduma-Olugu and Iyagba, 2009; Akyeampong, 2011). Previous studies demonstrate that

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residents feel urban tourism helps the economy (Ritchie, 1988), that tourism increases the standard of living of host residents, and that tourism helps the host community and country earn foreign exchange (Ahmed & Krohn, 1992). Also, tourism helps generate employment (Milman & Pizam, 1988; Ahmed & Krohn, 1992; Backman & Backman, 1997), and increase revenue to local business (Sethna & Richmond, 1978; Backman & Backman, 1997) and shopping facilities (Backman & Backman, 1997). This spirals into the economy of the larger society. Some research has been done on general issues of tourism in Lagos (Uluocha, 1999; Oshundeyi and Babarinde, 2003; Adejumo, 2005; Uduma-Olugu and Iyagba, 2009; Adejumo, 2010, Uduma-Olugu and Onukwube, 2012). Prior to this study there has not been any research directly measuring the public perception in connection with tourism development in Lagos.

Urbanization and Tourism

Lagos Nigeria, the coastal former capital city and commercial nerve center of the nation is beset with problems typical of such large cities of the world. Urban sprawl and its attendant demand for space is among such problems. While the city's ubiquitous water bodies and ecosystem offers vast opportunity for its development for tourism, unrestrained and insensitive development has impacted negatively on it thereby curtailing its potentials. Indiscriminate reclamation of wetlands, encroachment on river banks and lagoons, slum housing, deforestation poor spatial planning and land speculation (Abegunde, 1988; Oduwaye, 2009) are some of the ills unleashed on the urban center. Lagos is very important as a tourism destination in Nigeria. The region's high standing in the tourism sector is based on its large stock of tourism resources which range from sandy beaches and ecological and cultural resources to historical heritage. Among its many resources are a stock of different water bodies and waterways of which the Lagos Lagoon is one. The Lagos lagoon is the focus of this study. It is located in the heart of Lagos state, fed by several rivers and empties through the Lagos harbour to the Atlantic Ocean (Nwilo, Peters & Badejo, 2009). Inspite of the huge potential that exists for tourism, these resources remain largely untapped (Uduma-Olugu and Iyagba, 2009; Adejumo, 2010).

The study hopes to highlight the gains of a cleaner, unpolluted lagoon by exploring the perception of tourists and users of water tourism venues within the Lagos Metropolis towards the enhancement of the landscape resources of the lagoon for tourism. Currently, water is being mismanaged, as effluent and all manner of waste is pumped directly into the existing water bodies in Lagos, particularly the Lagos lagoon (Onyema, 2009). Its water is used as a disposal agent while its more valuable uses as a major asset for tourism and recreation is not being fully explored. Previous research, indicate that water tourism can be a major revenue source, particularly for developing economies like Nigeria (Visser & Njuguna 1992; Falade, 1998). This calls for change in the way the existing fringes of the Lagos waterways are currently being used.

Landscape Perception issues

Many factors can affect tourism development and the landscape of the place is one of the relevant determinants of why a tourism destination is perceived as attractive. One of the key indicators of a place's character, is its landscape – comprising not only of the landcover and landscape quality, but also of its very essence which can be captured when the landscape is assessed and evaluated, using pre-determined parameters (Swaffield, 1999). Corriera & Pimpao (2008) in their study confirmed that the landscape is one of three pull factors of motivation that influenced a tourist's

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choice of a destination. The basis of landscape perception for landscape assessment was laid by early studies by that K. Craik. L. Leopld, B. Linton, E. Shafer, J. Wohwill and E. Zube in the United States and K. Fines and his colleagues in Britain conducted pioneering studies in landscape perception and assessment during the late sixties (Ndubuisi, 2002). The study is necessary to examine the public perception of the Lagos lagoon and its potential as a tourism and landscape resource, from the point of view of its landscape characteristics. Its major aim is to measure the public's perception of the landscape characteristics of the Lagos lagoon, as it influences tourism development. To achieve this, the following objectives will be pursued;

1. To identify the primary users of the Lagos Lagoon tourism destinations
2. To examine tourists and visitors' perception of the landscape characteristics of the Lagos Lagoon
3. To determine which of the landscape characteristics of the Lagos Lagoon has an influence on its tourism development.

Study Area

The Lagos lagoon is the biggest of nine lagoons stretching from Republic of Benin to the Nigerian Niger Delta. Nwilo, Peters, & Badejo (2009) described the boundaries of the Lagos lagoon; the Southern margin of the Lagos lagoon is bounded by the Five Cowrie Creek, the Eastern margin by the Palaver Islands and the Northern border by Ikorodu. The lagoon is 40 - 64km long and has two arms: one connects the Lekki lagoon while the other leads northwards into the hinterland. The lagoon is fed mainly by the rivers of Ogun, Shasha, Oshun, Agboyi and Maijidun, the Ogudu creeks and waters of Epe and Lekki lagoons. Various activities go on in the lagoon. These include; transportation, sand mining/dredging, wood preservation, refuse disposal, slum housing, high income housing, markets, fishing, jetties, natural vegetation, rural housing, urban commerce, urban waste water drainage, recreation, institutional, etc.

The settlements that make up the Lagos lagoon waterfront are varied and contribute to its landscape characteristics –some are rural, others are urban while there is also a mix of urban and natural vegetation. These are interspaced with uninhabited swampy mangrove vegetation. Also along some of the waterfront abutting the Lagos lagoon, are shanties built on the water using makeshift materials, as well as wood preservation and sawmill market particularly at the Makoko and Okobaba end that generally deface the waterfront and make it unattractive for water tourism or recreation. The Third Mainland bridge of Lagos also traverses this lagoon, making it even more important and key landmark in the Lagos landscape.

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Figure 1.1: The Communities adjourning the Lagos lagoon shores

METHODS

Pictures of various aspects of the lagoon were taken and shown to respondents in three water-based tourism locations within the lagoon (University of Lagos Waterfront, Ipakodo Origin Zoo and Jetty, Ikorodu and Lekki Phase 1 clubhouse – the Pavilion), and three more popular locations along the Lagos coast (Bar Beach, Maiyegun/Gbara Beach (formerly Lekki Beach) and Alpha Beach). Out of 600 questionnaires, only 422 were correctly filled and used for the survey. The respondents were asked to rank on a scale of 1 to 5, the most beautiful, to the least beautiful. There were four sets of pictures, with five in each set. The pictures were based on totally urban, open spaces, landscape elements and human/social activities along the shores of the lagoon. The questionnaire contained other questions bothering on the respondents perception of the landscape characteristics of the lagoon as well as factors (tabulated, and on a likert scale), they were considered as having differing impact on tourism development on the lagoon. The questionnaires were distributed by research assistants at the locations on festive days and public holidays when a large population was expected based on an earlier survey (Uduma-Olugu and Iyagba, 2009). The statistical analyses of the data obtained were carried out with the aid of Statistical Package for Social Sciences (SPSS 16).

RESULTS AND DISCUSSIONS

The gender analysis of the respondents from Table 1 show that 65.4% were male while 34.6% were female. The average age of respondents was 28.3 years, out of which the highest number of respondents were mostly youths – aged 16 – 30 years (67.3%). The implication is that to a great extent people that visit such destinations are mostly young, and a lot of them are males. Respondents that fall under these age brackets are believed to have a lot of energy, dynamic and vibrant and are more likely to be engaged in active rather than passive recreation. The highest number of respondents live in Lagos metropolis 66.4%, the tourists – coming from outside Lagos from other towns in Lagos State, other states and other countries make up the balance – 16.8%, 13.3% and 3.6% respectively. This result was expected as the area does not seem to have a high traffic of tourists which is what necessitated the study in the first place.

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The Nationality of the respondents was also not surprising as 98.1% were Nigerians. Europeans (1.2%), North Americans (0.2%), Middle East (0.2%) and other African countries (0.2%) made up the balance. This clearly shows that tourism is not high at the venues since most of the visitors are Nigerians. The implication is that foreign tourists are not visiting the water-based tourism destinations. The tourism going on in is domestic from other towns within Nigeria.

Variable	Characteristics	Frequency	%	Mean	Total
Gender	Male	276	65.4		
	Female	146	34.6		422
Age	(Below 16) Years	6	1.4	28.3 Yrs	
	(16---30) Years	284	67.3		
	(31---45) Years	112	26.5		
	(46---60) Years	20	4.7		422
Employment Status	Retired	8	1.9		
	Office Worker	192	45.5		
	Student	92	21.8		
	Site Worker	11	2.6		
	Business	98	23.2		
	Educator	2	.5		
	Unemployed	19	4.5		422
Marital Status	Married	171	40.5		
	Divorced/Separated	8	1.9		
	Widowed	3	.7		
	Unmarried	240	56.9		422
Educational Qualification	Primary school	27	6.4		
	Secondary school	57	13.5		
	Technical school /Polytechnic	49	11.6		
	Graduate (e.g. B.Sc., B.A)	205	48.6		
	Post Graduate (e.g. M.sc or PhD)	84	19.9		422
Average Annual Income	Low income --- less than N500,000 per annum	85	25.4	N4,282,934	
	Middle income --- N500,000 - N10,000,000 per annum	232	69.5		
	High income --- more than N10,000,000 per annum	17	5.1		334
Place of Residence	Lagos Metropolis	280	66.4		
	Other town in Lagos State	71	16.8		
	Other State in Nigeria	56	13.3		
	Outside Nigeria	15	3.6		422
Nationality	Nigerian	414	98.1		
	European	5	1.2		
	North American	1	.2		
	Middle East	1	.2		
	Other African Countries	1	.2		422

Table 1: Summary of Socio-Demographic Variables

Table 2 shows the ranking of the totally urban aspects. In the first set of pictures comprising shots of totally urban aspects of the lagoon, the mean response of all the pictures were above 3.0, indicating that they were all considered beautiful with picture C (showing a high-rise luxury building) having the highest score of 70 and picture B (showing single storey buildings mixed with a lot of vegetation) having the lowest score of 62. Picture C also had the highest score in the entire 20 pictures ranked by the respondents.

Table 2: Ranking Of Landscape Perception of the Lagos Lagoon: Totally Urban

Picture	**LB**	**%**	**A**	**%**	**FB**	**%**	**B**	**%**	**EB**	**%**	**Total**	**Scale Mean**	**Response Mean**	**%**
Ranking of Picture: A	23	6.5	71	20.1	83	23.4	116	32.8	61	17.2	354	3.0	3.3	66
Ranking of Picture: B	33	9.3	76	21.5	96	27.2	110	31.2	38	10.8	353	3.0	3.1	62
Ranking of Picture: C	26	7.4	53	15.1	84	23.9	101	28.8	87	24.8	351	3.0	3.5	70
Ranking of Picture: D	28	8.0	68	19.3	97	27.6	107	30.4	52	14.8	352	3.0	3.2	64
Ranking of Picture: E	35	9.9	68	19.2	95	26.8	100	28.2	57	16.1	355	3.0	3.2	64
Total	**145**	**8.22**	**336**	**19.04**	**455**	**25.78**	**534**	**30.28**	**295**	**16.74**		**3.0**	**3.3**	**66**

Ranking of Landscape Perception of the Lagos Lagoon: LB (Least Beautiful), a (Average), FB (Fairly Beautiful), B (Beautiful), EB (Extremely Beautiful)

For the second set of pictures comprising shots of different landscape elements of the lagoon, Table 3 shows the mean response of four of the pictures were above 3.0, indicating that they were considered beautiful except for picture J which had a score of 2.9. Pictures F (showing grassland vegetation) and picture G (showing only the water) both have the highest score of 64 implying that they were jointly considered the best pictures by the respondents. Picture J (showing mangrove forest vegetation) had the lowest score of 62, as the least liked picture in the group.

Table 3: Ranking Of Landscape Perception of the Lagos Lagoon: Landscape Elements

Picture	**LB**	**%**	**A**	**%**	**FB**	**%**	**B**	**%**	**EB**	**%**	**Total**	**Scale Mean**	**Response Mean**	**%**
Ranking of Picture: F	29	8.1	68	19.0	114	31.8	82	22.9	65	18.2	358	3.0	3.2	64
Ranking of	36	10.2	81	22.9	82	23.2	98	27.8	56	15.9	353	3.0	3.0	64

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Picture: G														
Ranking of Picture: H	45	12.8	97	27.6	66	18.8	103	29.3	41	11.6	352	3.0	3.0	60
Ranking of Picture: I	49	13.9	69	16.5	90	25.5	107	30.3	38	10.8	353	3.0	3.0	60
Ranking of Picture: J	54	15.3	78	22.2	84	23.9	104	29.5	32	9.1	352	3.0	2.9	58
Total	**213**	**12.06**	**393**	**22.24**	**436**	**24.64**	**494**	**27.96**	**232**	**13.12**		**3.0**	**3.1**	**62**

Ranking of Landscape Perception of the Lagos Lagoon: LB (Least Beautiful), a (Average), FB (Fairly Beautiful), B (Beautiful), EB (Extremely Beautiful)

For the third set of pictures comprising shots of open spaces around the lagoon, Table 4 shows the scores were generally low. The mean response of three of the pictures were just above 3.0, indicating that they were considered beautiful except for pictures K and M which both had a score of 2.9. Picture O (showing grassland vegetation) had the highest score of 62 implying that it was considered the best picture by the respondents. Pictures K (showing fishing circles) and picture M (showing mixed vegetation) jointly had the lowest score of 60, as the least liked pictures in the group. The two pictures were not considered beautiful.

Table 4: Ranking Of Landscape Perception of the Lagos Lagoon: Open Spaces

Picture	**LB**	**%**	**A**	**%**	**FB**	**%**	**B**	**%**	**EB**	**%**	**Total**	**Scale Mean**	**Response Mean**	**%**
Ranking of Picture: K	63	17.2	85	23.2	81	22.1	98	26.7	40	10.9	367	3.0	2.9	58
Ranking of Picture: L	63	17.1	89	24.1	64	17.3	109	29.5	44	11.9	369	3.0	3.0	60
Ranking of Picture: M	59	16.0	82	22.3	81	22.0	115	31.3	31	8.4	368	3.0	2.9	58
Ranking of Picture: N	51	14.1	81	22.4	79	21.9	121	33.5	29	8.0	361	3.0	3.0	60
Ranking of Picture: O	52	14.4	65	18.0	93	25.8	98	27.1	53	14.7	361	3.0	3.1	62
Total	**288**	**15.76**	**402**	**22**	**398**	**21.82**	**541**	**29.62**	**197**	**10.78**		**3.0**	**3.0**	**60**

Ranking of Landscape Perception of the Lagos Lagoon: LB (Least Beautiful), a (Average), FB (Fairly Beautiful), B (Beautiful), EB (Extremely Beautiful)

Table 5: Ranking Of Landscape Perception of the Lagos Lagoon: Human and Social Activities

Picture	**LB**	**%**	**A**	**%**	**FB**	**%**	**B**	**%**	**EB**	**%**	**Total**	**Scale Mean**	**Response Mean**	**%**
Ranking of Picture: P	79	22.4	72	20.4	69	19.5	95	28.9	38	10.8	353	3.0	2.8	56
Ranking of Picture: Q	58	16.4	79	22.4	81	22.9	97	27.5	38	10.8	353	3.0	2.9	58
Ranking of Picture: R	64	18.5	91	26.3	65	18.8	89	25.7	37	10.7	346	3.0	2.8	56
Ranking of Picture: S	103	29.5	73	20.9	79	22.6	68	19.5	26	7.4	349	3.0	2.5	50
Ranking of Picture: T	68	19.6	52	15.0	88	25.4	79	22.8	60	17.3	347	3.0	3.0	60
Total	**372**	**21.28**	**367**	**21**	**382**	**21.84**	**428**	**24.48**	**199**	**11.4**		**3.0**	**2.8**	**56**

Ranking of Landscape Perception of the Lagos Lagoon: LB (Least Beautiful), a (Average), FB (Fairly Beautiful), B (Beautiful), EB (Extremely Beautiful)

Table 5 shows the results of the last set of pictures comprising shots of human and social activities around the lagoon, the scores were the lowest in the entire group of pictures. The mean response of only one of the pictures was 3.0 (Pictures T - showing mechanic village amidst a refuse dump), indicating that they were considered barely beautiful. All the others fell below 3.0 showing they were not considered beautiful. The picture with the lowest score in this group was picture S (showing slum housing on stilts) with a score of 50, as the least liked pictures in the group. This particular picture was generally considered least beautiful in this group**.** It also had the lowest score in the entire 20 pictures ranked by the respondents.

CONCLUSION

The results showed that the public perception of the landscape features of the lagoon is average. The respondents did not show a clear appreciation of the natural landscape over the urban aspects of the Lagos Lagoon. Most did not consider the lagoon's landscape beautiful. The picture that was most liked by the respondents was the one showing high rise luxury housing on the shores of the lagoon. The aspect of the lagoon least liked by the respondents were the portions that highlighted the unsightly human and social aspects –including the refuse dumps, mechanic village, wood processing, sand dredging and slum housing. The slum housing picture had the lowest score of the entire twenty pictures they had to choose from. This highlights the issue of slum housing as a major blight and deterrent for the development of the Lagos lagoon for tourism as even the locals identified it as a negative feature of the lagoon. The survey confirmed that the landscape characteristics of the Lagos lagoon influence its use as a tourist destination.

The results also show that 2/3rds of the people using the destinations live in Lagos – indicating that they are used more for recreation, than tourism (which requires travel and overnight stay). Of the remaining 1/3rd, very few tourists were foreigners at the locations surveyed; more domestic tourism is going on in the lagoon, than international tourism. This means that if the government is serious about developing tourism within the Lagos Lagoon, More needs to be done to attract foreigners to the area by providing the preferred facilities which they require. From the results, it appears that the destinations are frequented by middle income, young men below 30 years old. This group of people require facilities that they can engage in active sports or other tasking recreation, as such this should guide the provision of infrastructure to meet this need.

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RISK, RESILIENCE AND THE 'KNOWLEDGE CITY'

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ABSTRACT

The 'knowledge city' ('KC') enriches regional development with institutional and environmental domains. Its competitors in the new-economy regeneration stakes are the 'creative', 'green', 'intelligent' and 'smart' cities. All suggest planning foresight but contention surrounds philosophical underpinnings as well as specific recipes. Certainly, new-economy discourse condemns disconnected 'McMansions' and advocates for integrated, precinct-orientated and community-focused property development. But, extra outlays increase costs and only make financial sense if KC projects are de-risked. Here, we look for some indication that KCs inoculate against recession. Notwithstanding conceptual ambiguity, statistical and spatial concern, we investigate the KC resilience claim. Our findings suggest that knowledge-city score, however imperfect, does confers some post-GFC economic resilience but no more than a burgeoning middle class.

Keywords: demographics, knowledge city, new economy, resilience, risk,

INTRODUCTION

Real estate volatility (market risk) is influenced by both capital market and local space market conditions and prospects. Exuberant sentiment, loose credit, and lax fiscal or monetary policy drive capital markets bulls but, fluctuations in growth deter property investors. Economic resilience, indicated by continued output growth or stable unemployment, comforts nervous post-crisis investors and de-risks projects (Roberts and Henneberry 2007). 'Knowledge city' ('KC') credentials or a booming middle class could strengthen resilience in the wake of the Global Financial Crisis (GFC) by stimulating local demand, cutting vacancies and, over the longer-run with planning governance, incentivise the construction of quality buildings (D'Argensio and Laurin 2009). Hence, the research question for this paper is:

'What is a KC and does it confer economic resilience?'

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TOWARDS A KC MODEL

Institutional property investors concentrate on 'first-tier' cities or knowledge clusters which produce half the world's traded output (Global Metro Monitor 2010; OECD 2010). Such knowledge clusters include Silicon Valley, Cambridge in England or Helsinki. Paul Otlet ([1913] 1990) was perhaps the first to articulate links between cities and knowledge dissemination. In economics, Hayek (1945) put knowledge centre stage and Rothschild and Stiglitz (1976) destroyed comforting notions of equilibrium in a world of imperfect information. Soon institutions such as The Centre for Economic Policy Research(OECD) included knowledge and innovation indicators in their statistics (Benoît 2006; Peters 2009).

Urban variety (Blumenfeld 1955), precludes a 'one size fits all' KC model and narrow technological variants vie with more socially inclusive, pedestrian or 'quality of life' discourses (Wadley 2010; Alves and Ramalho 2011; Goede 2011). Despite its ambiguous 'hard' or 'soft' formulation, governments and cities, under competitive pressure, espouse Knowledge Based Urban Development ('KBUD') (Australian Federal Government 2010). However, as with any collective betterment intervention, KC can be misconstrued, misapplied or misappropriated. Lopsided planning can become a 'sterile monologue of totalitarian power' (Mumford 1961: 211). Hall (1999), in the tradition of Geddes (1949 [1919]: 25) seeks 'civic and regional reorganisation' for social survival and success but favours cultivation of an 'innovative milieu' rather than grandiose planning. Historically, urban utopias, such as 'Fordlandia' and 'New Australia' were dismal failures (Grandin 2009). Planned cities like Brasilia or Abuja, in Nigeria, have become the 'irrational' spatial embodiment of a dysfunctional 'collective contrivance' (Mumford 1961: 622; Brown 2009). New Songdo City in Korea is a modern example of a, as yet, untested technological urban utopia (McNeill 2009). Figure 2 presents one take on the dimensions of KBUD

A necessary condition for a 'KC' is a clean air and water. Other KC domains (so of which are discussed) include:

- Environment
- Governance
- Communities
- Technology
- Urban form

Community

The 'KC' is underpinned by rich communities of educated, tolerant and skilled people who trust each other and share a common purpose (Murphy, 2009). The problem is that fostering human capital is expensive, time-consuming and complex, certainly beyond an electoral cycle. Most, countries lack the political capacity to undertake substantive educational or other reforms. Public-relations manoeuvrings is far easier. Alternatively, structural reform can be short-circuited by bringing in talent. For Florida (2005) tolerance of diverse minorities ignites cultural and commercial creativity. For Landry (2006: 271) talent and tolerance are not enough to spark or sustain a KC's 'creative milieu'. Creativity requires 'multi-faceted resourcefulness' so that 'merely holding [cultural] festivals does not mean a city is creative'. As Scott (2006: 15) states: 'creativity is not something that can be simply imported into the city on the backs of

peripatetic computer hackers, skateboarders, gays, and assorted bohemians but must be organically developed through the complex interweaving of relations of production, work, and social life in specific urban contexts'.

Governance, institutions, policy and technology

While, economic opportunity sparks and technology fuels knowledge cities, if it is poorly governed they fizzle out. Stoking a boom in an engineered city without reform of the spatial political economy merely stirs 'the surface froth and evanescence so characteristic of flexible accumulation' (Harvey 1989: 187). Without the lifeblood of robust institutions and rule of law, a KC withers. Governance ensures collective imperatives do not trammel individual rights and prevents bureaucratic managerialism smothering the entrepreneurial spirit. Fake transposed 'new economy' city blueprints or the 'architectural megalomania' and 'hallucinatory pastiche' of Dubai (Davis 2006: 51) won't work (Hall 1998; Scott 2006).

Some dismiss KC notions as a cynical legitimacy exercise to cover misspending or malignant real estate development. Manipulation of urban form alone is necessary but insufficient to foster substantive innovation. Indeed, questions linger about the significance of place architecture for the transmission of 'tacit knowledge in modern networked society (Castells 1996). One could argue that street life or accidental face-to-face encounters played a limited role in the genesis of revolutionary science for Galileo, Newton, Darwin or Mandelbrot (1983). For Håkanson (2005) most significant information is exchanged and new ideas are generated at work. Policy which facilitates education, training and labour mobility could be more effective at stimulating innovation than grandiose projects to reconfigure city urban form. In this view, KC function evolves from sustained sensible policy, technology diffusion and favourable demographics within robust institutions. Where some KC form intervention is needed, Ho (2000) suggests its mechanics involve the coordination of multiple agencies. To conclude, the KC concept is fuzzy and merges with the creative city within 'new economy' discourse. A KC 'illustrates the complexity of interactions between the micro and macro' (Chapain and Lee 2009: 160). In short, some of the policy architecture (e.g. rule of law and education) for a successful KC is national and there is no local unique KC prescription (Lorenzen 2010).

Urban form

The KC puts constraints on urban form, insisting on walkable or 'convivial' neighbourhoods which are aesthetically pleasing and connected to quality amenities to facilitate intermingling. In a KC, the talented workforce connects seamlessly by foot or on public transport 'community precincts'. These neutral public realms counteract spatial segregation and facilitate community connectedness. In former times, Piazza St Marco in Venice functioned to devolve commercial and political power spatially although now its role is largely a tourist spectacle. Appropriate amenities could include museums and some bars or restaurants where brokers can easily network (Gallo 2010) as well as 'artistic squats' (Vivant 2011). From the wider collective imperative, crass instrumental consumption spaces such as overcrowded malls, bowling alleys, football clubs and movie theatres are no use for the KC (Weber 1958[1905]; Gottdiener 2003; Glaeser *et al*. 2004). In the KC, the social and productive potential of bars, clubs and discothèques varies with their symbolic or sexually coded atmosphere (Knopp 2003). 'Bohemian' bars could conceivably provide conduits to catalyse productive innovation. However, fancy projects disconnected from infrastructure and without a

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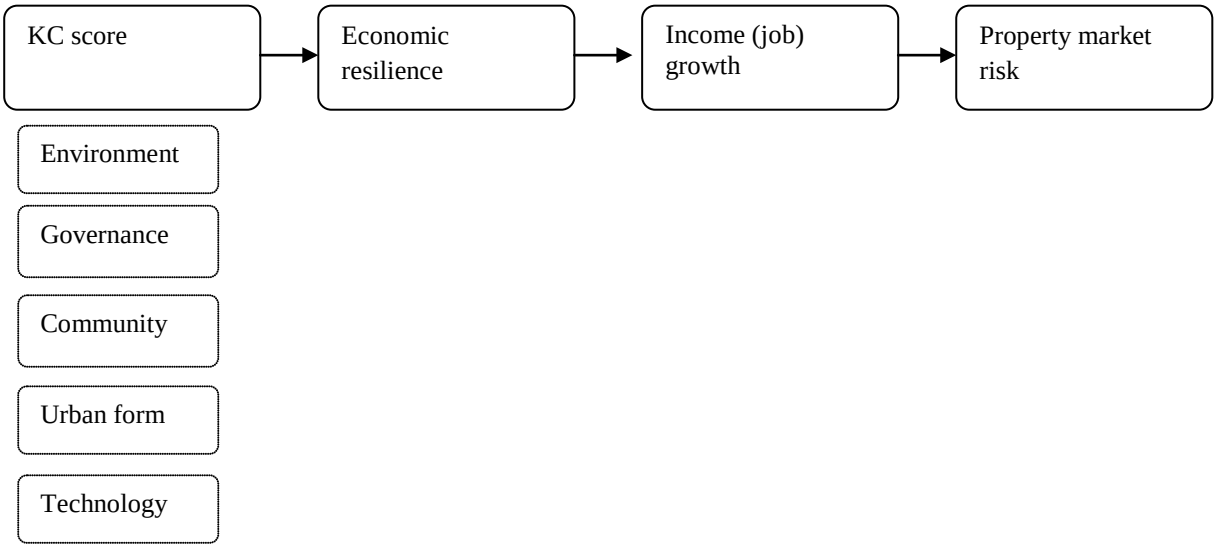
talented clientele, even if decked out in trendy 'European' décor, only purvey a commoditised illusion of liberated social discourse and mask alienation, isolation and desperation (Martinus 2011).

In auditory terms at the street level, the KC generates a 'hubbub', not traffic noise. In fact, in the KC, carefree chatter mingles with informed discourse and music. In a KC, convivial areas are separated from vehicular traffic but not by buildings which affront aesthetic sensibilities. The urban form of the KC is beautiful, but not necessarily in a classical mode. Aesthetics is contextual but proportion or even fractals transcend conventional classical constraints restricting the authenticity of architectural innovation. Places in the KC, are convivial and uncluttered, uplifting and authentic.

MODEL METHOD AND DATA

Figure 1 illustrates how KC score is transmitted via economic resilience in income and job growth or contraction.

Figure 1 KC domains and transmission to indicators of economic resilience



The investigation compiled data from several sources to determine post-GFC resilience. There were some obvious limitations. First, KC index scoring is problematic (Høyland *et al.* 2011). Second, corresponding data was not available across some cities which distorted the sample frame, See Table 1.

Table 1: Extract of KC ranking, risk and performance data

(Sources: Grant and Chuang 2010; D'Argensio, J.-J. and F. D. R. Laurin (2009); Brookings Institution LSE Cities (2010) and Kapas, M. and Liang, Y. (2009)

Location	Citycardkc_2	Sovereign risk	Gwth consumer	Income2	Jobs20
Beijing China	62.12	-1.73	20.3	5.4	3.9
Mexico city	62.93	2.74	9.5	3.8	1.3
Rio de Janeiro	55.84	3.19	8.7	6.2	3.2
Moscow Russia	56.57	5.18	11.6	3.5	0.4
Sao Paulo Brazil	45.9	3.19	8.7	3.5	1.6
Hong Kong China	76.55	-1.73	20.3	5.5	0.8
Shanghai China	65.83	-1.73	20.3	7.5	3.1
Warsaw Poland	24.31	0.89	10	2.4	0.8
Prague Czech Rep.	66.1	0.33	4.6	1.7	-0.5
Lima Peru	58.67	3.45	8.6	5.6	5.7
St. Petersburg	34.08	5.18	11.6	NA	NA
Buenos Aires	66.54	5.02	10	4.2	3.1
Istanbul Turkey	57.2	-4.29	11.6	5.5	7.3
Tianjin China	58.67	-1.73	20.3	6.4	1.8
Sofia Bulgaria	58.67	4.06	9.6	-0.5	-1
Bangkok Thailand	65.71	-2.12	12.1	3.3	1.2
Bratislava	58.67	0.37	5.4	3.3	0.2
Guangzhou China	48	-1.73	20.3	7.4	2.5
Budapest Hungary	32.3	-0.21	8.2	0.4	-0.5
New Delhi India	39.93	2.02	21.7	1	2.9
Santiago Chile	35.03	2.82	11.4	4.3	6.2
Kuala Lumpur	34.41	2.84	11.8	5	2.2
Bucharest	58.67	0.99	12.6	2.5	-0.2
Bogota Columbia	51.31	3.45	11.1	2.6	2.7
Shenzhen China	25.65	-1.73	20.3	5.9	5.9
Mumbai India	44.81	2.02	21.7	6.4	2.8
Manila Philippines	32.62	5.31	13.9	5.3	4
Taipei Taiwan	66.09	-2.84	20.3	6.4	1.3
Bangalore India	48.33	2.02	21.7	6.3	2.6
Jakarta Indonesia	39.46	-1.37	16.8	5.3	2.2
Kolkata India	43	2.02	21.7	6.3	2.2
Kiev Ukraine	58.67	3.16	18.1	NA	NA
Chongqing China	28.23	-1.73	20.3	NA	NA
Caracas Venezuela	27.95	4.78	7.5	NA	NA

STATISTICAL ISSUES

Any spatial rendering of 'KC' analysis confronts statistical issues, the most pertinent of which are:

- Sample frames
- Spatial resolution
- Access definitions

Ideally, KC analysis should proceed based on stratified random sample to reduce costs without compromising variability (Clifford 2011). Some KC studies present lists of cities for which statistics are readily available without randomised selection from a rationally constructed sample frame. Boundary specifications in many studies are

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vague. Spatial resolution is also a significant problem since many 'KC' indicators are collected at the national level. Oftentimes, reliable price data is unavailable. Hence, a limitation for the study was the use of intermediate urban economic growth to get insight into likely office investment performance. A more robust future study should randomly select buildings from the randomly generated cities under investigation and collect longitudinal property level data on total risk-adjusted returns. Finally, often KC studies are woefully deficient with respect to concrete indicators of local urban form conviviality on the ground. In this regard, access to useful facilities or distance from hazards and nuisances should be modelled on network linkages not Euclidean distance (Nair 2011).

FINDINGS: ALTERNATE DRIVER: MIDDLE CLASS DEMOGRAPHICS

Statistical limitations notwithstanding, the results suggest a link between KC, as indicated by CityCard 2010 score, post-GFC income resilience as illustrated in Figures 2 and 3 below. While Figure 3 suggests that KC confers no economic resilience, nearest-neighbour analysis, in Figure 3, unmasks the confounding effect of fast middle class growth in some developing countries to reveal KC resilience contribution. The nearest-neighbour statistic, R, is 'the degree to which an observation departs from an expected random pattern' (Rossbacher (1986: 1). R suggests that post-GFC economic resilience is linked to KC but in two separate sub-markets: established (low risk sovereign) cities and emerging (higher risk) cities with rapidly expanding consumer classes.

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Figure 2 Apparent lack of relationship between KC index and post-GFC resilience.

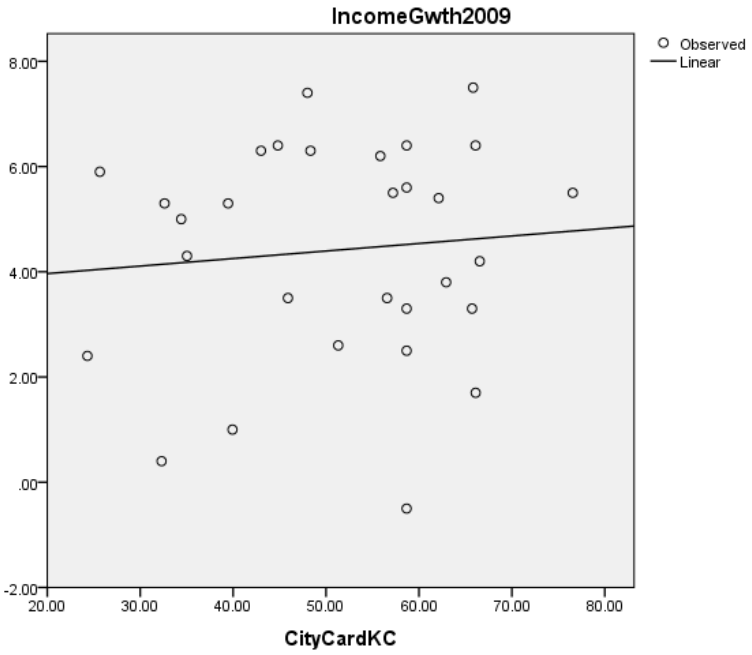
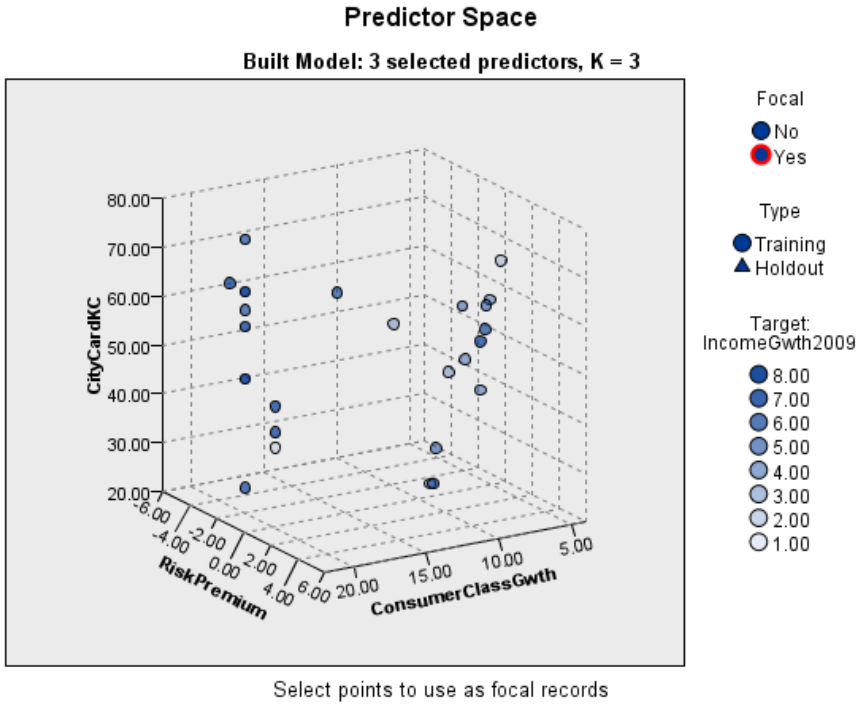


Figure 3 Nearest neighbour analysis, disentangles the confounding KC and population growth drivers.



CONCLUSION

Our preliminary investigation into the knowledge city concept finds it conflicted with antecedents in regional development. In the urban regeneration stakes, the knowledge city vies for popularity with other new economy contenders, including the 'creative city'. Notwithstanding conceptual ambiguity and significant statistical concerns, our preliminary investigation found it confers post-GFC resilience but no more than burgeoning middle-income populations. The implication for investors is that direct property portfolios should be diversified both across KC and high middle class population growth cities. City authorities, seeking to lure private investment should consider an appropriate KC marketing campaign in conjunction with concrete measures to improve public transport logistics, aesthetics, pedestrianisation and coherent place-making. In short, despite some definition ambiguity, the KC concept remains relevant. Particularly attractive locations for investors are KCs with a rapidly expanding middle class.

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