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Value Chain analysis for opportunity exploitation in software industry

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Abstract

Competitive advantage defines a powerful tool that strategic managers need for recognizing and increasing company's competitive advantage, this tool is called the value chain. Famous software companies in the world have been able to capture the market of software products by good understanding of the market, value chain analysis and appropriate planning. Software value chain includes effective and important components in creating competitive advantage that should be analyzed. In this study the effective factors in competitive advantage and analysis of software value chain components are discussed. Research methodology is mixed of qualitative – quantitative and practical method. After reviewing the literatures and gathering researches since 2000 to 2012, using interviews and analysis of qualitative data with coding them, important and effective components of software value chain were identified and by the use of these components questionnaire was developed. After distributing the questionnaire, factor analysis was accomplished to identify the major components of the value chain in the software development. Finally, components analysis of the software value chain was done for enhancing competitive advantage compared with competitors.

KEYWORDS:value chain analysis, critical success factors, opportunity exploitation, software industry

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Introduction

Value chain analysis offers opportunity to managers to separate company's activities like designing, manufacturing, marketing, distribution of goods and services. All of value activities that are performed by a company in the industry have common factors that competitive advantages can be obtained by them.

Software giants have been able to capture the market of software products by identifying competitive advantages, good understanding of the market and appropriate planning. These products cover a large part of the requirements. The markets have been captured by these companies so that it will be hard for newcomers to compete with them. So by finding new competitive advantages in software industries, identifying value chain components, and focusing on value chain analysis of this industry, opportunity exploitation of main value chain components, with mechanisms such as selection of appropriate distribution channels, maintenance and software upgrades, advertising and laying plot, we can be hope to get a suitable share of the market.

Critical success factors are "those characteristics, conditions or variables that, when properly sustained, maintained or managed, can have a significant impact on the success of a firm competing in a particular industry."(Leidecker, Bruno,1984; Leidecker, Bruno, 1987). Acording to John F. Rockart (1979), critical success factors...are...the limited number of areas in which results, if they are satisfactory, will insure successful competitive performance for the organisation (Rockart, 1979, p.85). As a result, the critical success factors are areas of activity that should receive constant and careful attention from management (Rockart, 1979, p.85; Bullen,Rockart; 1981, Rockart, 1982).

According to definitions of Rockart (1979), Chiristin V. Bullen (1981), Joel K. Leidecker (1984,1987) and Albert V. Bruno (1984,1987) about critical success factors that were mentioned above, in this paper we used concept of critical success factors for identifying important and effective components of software value chain to create competitive advantage.

An **opportunity** is an idea or dream that is discovered or created by an entrepreneurial entity and that is revealed through analysis over time to be potentially lucrative (Short et al., 2010, p.55). The roots of the opportunity concept are found in Austrian economics. According to Israel M. Kirzner (1973), the defining characteristic of entrepreneurs is that they are ''able to perceive opportunities for entrepreneurial profits; that is, they are able to see where a good can be sold at a price higher than that for which it can be bought''. With Joseph Schumpeter (1934), there is another eminent Austrian – at least by birth – among the pioneering thinkers on entrepreneurship. Schumpeter does not explicitly feature the opportunity concept. Instead, his point of departure is the notion of innovation characterized as ''new combination''. The entrepreneur is an individual who creates a new combination and pursues it in the market (Buenstrof, 2007, p.324-325).

Opportunity exploitation refers to building efficient, full-scale operations for products or services created by, or derived from, a business opportunity (Choi et al., 2008, p.335). Exploitation is, in turn, associated with the production startup milestone or, said differently, full-scale operation, which requires full commitment of the new venture's resources in building efficient production and business systems (Choi et al., 2008, p.335). Exploitation of entrepreneurial opportunities is realized through the creation of new companies and individual risks. Thus, identifying effective components in value chain for

opportunity exploitation in software industry is the start of new companies establishment and successful continuation of entrepreneurial activities. Most opportunities that recognized, don't lead to correct exploitation and operation. That's because the exploitation, venture creation and foundation of new company depend on factors that entrepreneurs do not pay attention to them. To identify these factors, the context of critical success factors is used. For this purpose, the entrepreneurial process models for identification of critical success factors and value chain components in exploiting opportunities are inspected. William B. Gartner (1985) in process model mentioned that four elements including, individual(s), organisation, environment and process are involved in creating a new company. All these factors have a direct connection with the creation of new companies that are depicted in Figure 1 (Gartner, 1985, p.698). Alvaro Cuervo (2005) has suggested a model with integrating three explanations of entrepreneurial activity that includes: personal characteristics, economic environment and institutional environment (Cuervo, 2005, p.229). These factors led to performance and wealth creation.

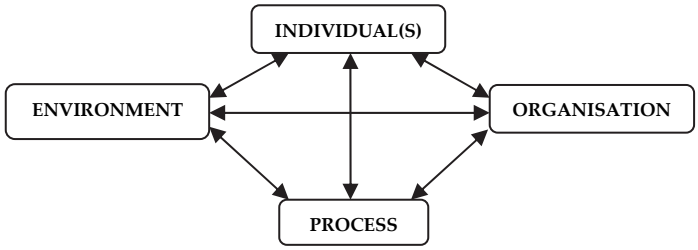

Fig.1: New company creation variables

Source: Gartner, 1985, p.698

Considering the importance of subject, after introductionand theoretical background sections, conceptual framework and research methodology are presented, and in the next section analysis of findings are investigated and finally conclusion and discussion about this paper are offered.

Theoretical Background

Competitive advantages introduces the concept of value chain, a general framework for thinking strategically about the activities involved in any business and assessing their relative cost and role in differentiation(Porter, 1985). Competitive advantage cannot be understood by looking at a firm as a whole. It stems from the many discrete activities a firm performs in designing, producing, marketing, delivering, and supporting its product. Each of these activities can contribute to a firm's relative cost position and create a basis for differentiation (Porter, 1985. p33).

The value chain, developed by Michael E. Porter (1985) and his associates at the Harvard business school, is a useful method of understanding and controlling the costs involved in a wide variety of organisational enterprises (Boehm, Papaccio, 1988, p.1469). It identifies a canonical set of cost sources or value activities, representing the basic activities an organisation can choose from to create added value for its products (Boehm, Papaccio, 1988, p.1469). The value chain disaggregates a firm into its strategically relevant activities in order to understand the behaviour of costs and the existing and potential sources of differentiation (Porter, 1985. p57). A firm gains competitive advantage by performing these

strategically important activities more cheaply or better than its competitors (Porter, 1985. p57). These are divided into what Porter (1985) calls primary activities (inbound logistics, outbound logistics, marketing and sales, service, and operation) and support activities (infrastructure, human resource management, technology development, and procurement) (Porter, 1985, pp.39-43; Boehm & Papaccio, 1988, p.1469).

To explain the research framework and value chain analysis, Porter's value chain concepts and components that have been examined by Barry W. Boehm and Philip N. Papaccio (1988) for software development should be discussed, and the significance of each component should be divided by considering the overall cost of software development (Figure 2).

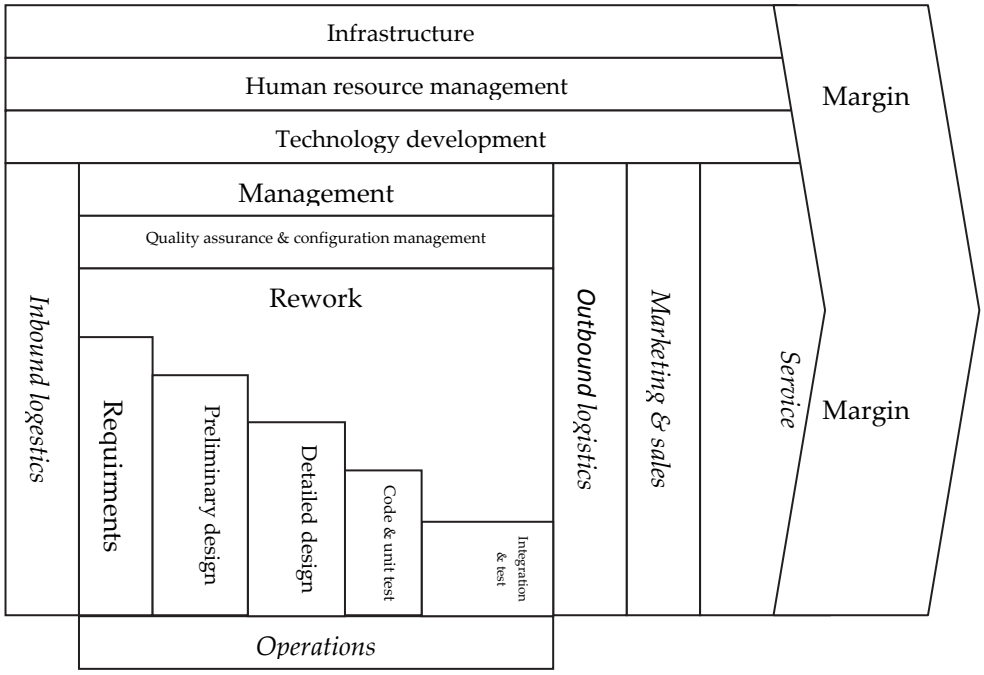

Fig.2: Software development value chain

Source:Boehm,Papaccio, 1988, p.1469

Primary activities; **Inbound logistics** covers activities associated with receiving, storing, and disseminating inputs to products (Porter,1985, p.39; Boehm,Papaccio, 1988, p.1469). For software it consumes less than 1 percent of the development outlay (For software, the related support activity of procurement is also included here) (Boehm, Papaccio, 1988, p.1469).

Outbound logistics covers activities concerned with collecting, storing, and physically distributing the product to buyers (Porter, 1985, p.40; Boehm,Papaccio, 1988, p.1469). Again, for software, this consumes less than 1 percent of the total (Boehm,Papaccio, 1988, p.1469).

Marketing and Sales covers activities associated with providing a means by which buyers can purchase the product and inducing them to do so (Porter, 1985, p.40; Boehm,Papaccio, 1988, p.1469). A 5 percent figure is typical of government contract software organisations (Boehm,Papaccio, 1988, p.1469).

Service covers activities associated with providing service to enhance or maintain the value of the product (Porter, 1985, p.40; Boehm,Papaccio, 1988, p.1469). For software, this comprises the activities generally called software maintenance or evolution (Boehm, Papaccio, 1988, p.1469).

Operations covers activities associated with transforming inputs into the final product form (Porter, 1985, p.40; Boehm,Papaccio, 1988, p.1469). For software, operations typically involves roughly four-fifths of the total development outlay (80%) (Boehm,Papaccio, 1988, p.1469).

Support activities: **Infrastructure** covers such activities as the organisation's general management planning, finance, accounting, legal, and government affairs of the organisation (Porter, 1985, p.43; Boehm,Papaccio, 1988, p.1469). The 8 percent figure is typical of most organisations (Boehm,Papaccio, 1988, p.1469).

Human resource management covers activities involved in recruiting, hiring, training, development, and compensation of all types of personnel (Porter, 1985, p.42; Boehm, Papaccio, 1988, p.1469). Given the labor-intensive and technology-intensive nature of software development, the 3 percent figure indicated here is a less-than-optimal investment (Boehm, Papaccio, 1988, p.1469).

Technology development covers activities devoted to creating or tailoring new technology to improve the organisations products or processes (Porter, 1985, p.42; Boehm,Papaccio, 1988, p.1469). The 3 percent investment figure here is higher than many software organisations, but still less tan optimal as an investment to improve software productivity and quality (Boehm, Papaccio, 1988, p.1469).

Margin and service: margin in the value chain is the difference between the value of the resulting product and the collective costs of performing the value activities. As this difference varies widely among software products (Boehm,Papaccio, 1988, p.1469).

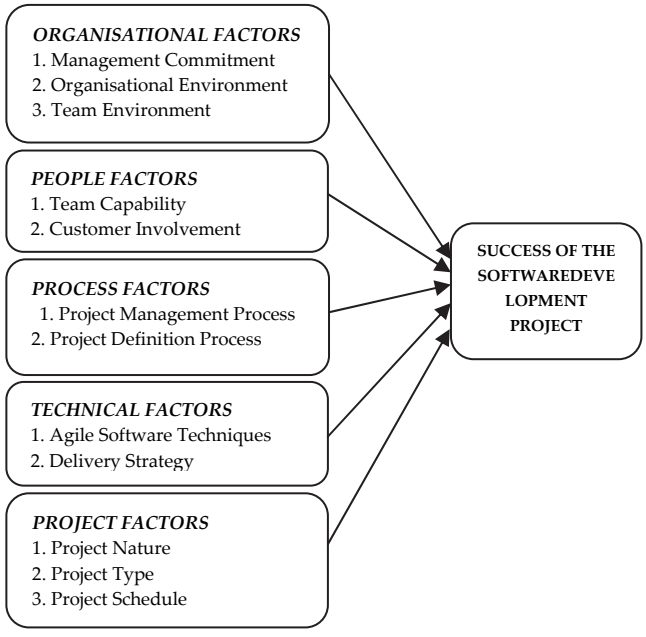

Fig. 3: Value chain effective components in software projects

Source:Chow,Cao, 2008, p. 964

In Figure 3, presented by Tsun Chow and Dac-Buu Coa (2008), 12 factors of CSFs for success of agile projects have been classified into five categories including: people factors, technical factors, project factors, organisational factors and process factors.

In this paper for identifying effective components in value chain (Figure 2), conceptual dimensions of Figure 1 and Figure 3 were used which are related to software development projects and opportunity exploitation dimensions.

In this paper, the researches since 2000 to 2012 were noted. After several reviews of these papers, those ones were selected that have investigated the critical success factors and most important value chain effective components. After reviewing the papers and results of their investigations with respect to Figure 1 and Figure 3, a summary of research results were classified in Table 1.

Table 1: Identified value chain effective components via literature reviwe

	Effective component in value chain	References
	Organisational Factors	
1	Senior management commitment and support, Leadership	(Cao, 2006), (Chow,Cao, 2008),(Nasir,Sahibuddin, 2011), (Cabinet Office, 2000), (Nfuka, Rusu, 2010), (Boghossian, 2002), (Wang, 2010), (Wan,Wang, 2010), (Niazi et al., 2006), (Habib, 2009), (Sudhakar, 2012), (Sheffield & Lemetayer, 2012), (Prabhaker, 2008), (Fortune, White, 2006)
2	Environment and Organisational culture	(Cao, 2006), (Chow,Cao, 2008), (Wan,Wang,2010), (Niazi et al., 2006), (Misra et al., 2009), (Habib, 2009), (Sheffield,Lemetayer, 2012), (Fortune,White, 2006)
3	Team environment, Communication & collaboration, Learning & couching	(Cao, 2006), (Chow,Cao, 2008), (Nasir,Sahibuddin, 2011), (Wang, 2010), (Niazi et al., 2006), (Misra et al., 2009), (Habib, 2009), (Wan, Wang, 2010), (Sudhakar, 2012), (Prabhaker, 2008), (Fortune,White, 2006)
4	Optimal & real budget, Optimal resource allocation	(Cao, 2006), (Nasir, Sahibuddin, 2011), (Nfuka,Rusu, 2010), (Habib, 2009), (Niazi et al., 2006), (Boghossian, 2002), (Fortune, White, 2006)
5	Goals, vision and target	(Nasir,Sahibuddin, 2011), (Boghossian, 2002), (Wan,Wang,2010), (Niazi et al., 2006), (Sudhakar, 2012)
6	Customer Satisfaction	(Niazi et al., 2006), (Misra et al., 2009), (Sudhakar, 2012)
7	Reward system	(Cao, 2006), (Niazi et al., 2006)
	People Factors	
1	Skills and competencies	(Cao, 2006), (Chow,Cao, 2008), (Nasir,Sahibuddin, 2011), (Cabinet Office, 2000), (Nfuka,Rusu, 2010), (Boghossian, 2002), (Wan,Wang, 2010), (Niazi et al., 2006), (Misra et al., 2009), (Habib, 2009), (Sudhakar, 2012), (Sheffield,Lemetayer, 2012), (Fortune,White, 2006)

2	Team & Customer Collaboration and involvment	(Cao, 2006), (Chow,Cao, 2008), (Nasir,Sahibuddin, 2011), (Nfuka & Rusu, 2010), (Boghossian, 2002), (Niazi et al., 2006(, (Habib, 2009), (Misra et al., 2009), (Sheffield, Lemetayer, 2012), (Prabhaker, 2008), (Fortune,White, 2006)
3	Team & customer motivation and effort	(Cao,2006), (Nasir,Sahibuddin,2011), (Wang, 2010), (Misra et al., 2009)
Process Factors		
1	Project management process	(Cao, 2006), (Chow, Cao, 2008), (Nasir,Sahibuddin, 2011), (Cabinet Office, 2000), (Boghossian, 2002), (Niazi et al., 2006), (Habib, 2009)
2	Project definition process	(Cao,2006),(Chow,Cao, 2008), (Boghossian, 2002)
3	Risk management	(Cao,2006), (Nasir,Sahibuddin, 2011),(Cabinet Office,2000), (Nfuka,Rusu,2010), (Fortune,White, 2006)
4	Configuration, change and requirement management	(Cao,2006), (Nasir,Sahibuddin, 2011),(Prabhaker,2008)(Fortune, White, 2006)
5	Quality management and quality assurance	(Nasir,Sahibuddin, 2011), (Niazi et al., 2006), (Sudhakar, 2012)
Technical Factors		
1	Software technologies, Design patterns and advanced methods, Infrastructures	(Cao, 2006), (Chow,Cao, 2008), (Nasir, Sahibuddin, 2011), (Wan,Wang,2010), (Prabhaker, 2008)
2	Delivery strategy, Support & education	(Cao, 2006), (Chow,Cao, 2008), (Nasir,Sahibuddin, 2011), (Cabinet Office, 2000), (Nfuka,Rusu, 2010), (Wan,Wang, 2010), (Niazi et al., 2006), (Misra et al., 2009)
3	Clear requirement and specification	(Nasir,Sahibuddin,2011), (Boghossian, 2002)
4	Standards, procedures and documentation	(Cao, 2006), (Niazi et al., 2006), (Sudhakar, 2012)
Project Factors		
1	Project nature	(Cao, 2006), (Chow, Cao, 2008), (Nasir,Sahibuddin, 2011)
2	Project type	(Cao, 2006), (Chow,Cao, 2008), (Nasir,Sahibuddin, 2011)
3	Project scheduling, Appropriate planning , Control	(Cao,2006), (Chow,Cao, 2008), (Nasir,Sahibuddin, 2011), (Cabinet Office, 2000), (Boghossian, 2002), (Misra et al., 2009), (Sudhakar, 2012), (Prabhaker, 2008)
4	Distribution and team size	(Cao, 2006), (Misra et al., 2009), (Sheffield & Lemetayer, 2012)
5	Review	(Niazi et al., 2006)

Conceptual Framework

The purpose of this study is value chain analysis for exploitation of opportunities in software industry. Figure 2 shows the software development value chain that is developed by Boehm and Papaccio. Figure 3 shows the framework that is suggested by Chow and Cao and 12 major components of the software development are categorized in five dimensions. Figure 1 shows the framework that new venture creation major components for opportunity

exploitation are categorized in four dimensions. Basis model and conceptual framework of this study is compound of models in Figure 1, Figure 2 and Figure 3, Important and final effective components have been considered and studied in these framework.

Research Methodology

This research method is mixed method (qualitative & quantitative) and practical. Information gathering about the theoretical background of the research has been used with library resources, articles and books. In order to data analysis content analysis, interviews and systematic qualitative research (Open and axial coding) (Glaser, Strauss, 1967; Bazargan,2008) methods has been used to reduce the classification of effective components. Statistical population of this research is software companies in Tehran.

Sampling method in qualitative part was intentional and non-probabilistic (snowball). Qualified individuals were selected for interviews. Until theoretical saturation (sufficient data), interview was used. Measuring instruments was semi-structured interview. Interviews were conducted with 18 persons from software project management and software industry experts.

Reliability of qualitative part was confirmed by helping research assistant, experts, structural confirmation and revision in the time of coding. After each interview, the collected data with the help of research assistant has been classified and analyzed. After the next interview, previous results were confirmed or rejected by the interviewees.

After analyzing qualitative data by using identified components, questionnaire was prepared for quantitative part. The sampling size method in quantitative part was Cochran's formula. Using Cochran formula and considering the 850 software development companies in Tehran, sample size was identified 264 companies. Random sampling method was chosen for filling out the questionnaire. Tool for quantitative measuring is questionnaire (Likert scale) that questions in it have been chosen based on the literature review and results of interviews.

For masuring content validity of questionaire, questionareis were distributed among some experts and software industry managers. How much they agreed with each factor in the framework was obtained and validity problems and necessary structural reforms were corrected to meet content validity. Consistency and internal stability was estimated using Cronbach's alpha reliability coefficient. Using the SPSS, reliability of questionnaire (Cronbach's alpha) was obtaind for the 44 items that equals to 0.922; it shows good reliability of indicator.

After collecting the acceptable questionnaires, factor analysis was used to reduce components and identifying and classifying the main final components. Factor analysis is any of several methods for reducing correlational data to a smaller number of dimensions or factors; beginning with a correlation matrix a small number of components or factors are extracted that are regarded as the basic variables that account for the interrelations observed in the data(Sarmad et al., 2010).

Finally, quantitative data analysis was accomplished by placing components in the value chain and investigating the rate of importance of components.

Finding Analysis

Qualitative finding analysis

After classifying the research background by help of experts, interviewing with managers of software companies, coding and analyzing for several times 16 effective components of the value chain in exploitation of opportunities in software industry (Table 2) were identified.

Table 2: Software value chain effective components (qualitative part)

Infrastructure	
Senior management commitment and support	
Human Resource Management	
Reward system according to individual morale	
Technology Development	
Software technologies	
Service, Marketing & sales	**Operations**
Support, Customer acceptance, Delivery strategy	*People Factors*
	Skills and competencies, Motivation and effort
	Organisational factors
	Environment and Organisational culture, Communication and Team & Customer collaboration, Distribution and team size
	Process Factors
	Project management process, Change & requiremenet management, Clear requirement
	Project Factors
	Precise definition of project scope, Appropriate schaduling

Then by using Table 1, Table 2, and results of qualitative data analysis, 44 questions were provided for questionnaire and phrasing of sentences and factors were corrected for greater perception and greater accuracy by help of experts as in second column of Table 3.The final questionnaire was used to collect experts and manager's opinions of software industry via verbal, e-mail and google docs, and finally 73 completedquestionnaires were accepted.

Quantitative finding analysis

After collecting the questionnaires, factor analysis was performed on data, using SPSS with 44 factors (questionnaires' questions) andusing PCA (Principal content analysis). The result of Bartlett's test that is an approximat of chi-squared statistic was calculated. Significantlevel of Bartlett's test is less than 5% (0.000), indicating that factor analysis is appropriate to identify the model structure and a known assumption about correlation matrix is rejected. The KMO index value was 0.629. As its value is greater than 0.6, the number of samples are adequate for factor analysis.

Identified parts and components by factor analysis showed that the eigenvalue of factors number 1 to 12 are greater than 1 and will be retained in the analysis. These 12 factors can explain 74.229% of the variability (variance) of variables. With reviews of the

rotated component matrix and identifying the highest value in each row, after sorting and placing factor in the respective categories, Table 3 was obtained thataccording to the background of research, interviews and collaboration of experts, common and more generall titles have been considerdfor 12 factors in the last column.

Table 3: Component categorized and identified factors (factor analysis)

	Ordered factor according to Factor Analysis	Categorized and identified factors according to Factor Analysis
1	Project manager's technical expertise	**Project management**
2	Arts and project management skills	
3	The best way people communicate within a team managed by a project manager	
4	Best way cooperating management in project team by project manager	
5	Accompaniment with users and managers by project manager	
6	Well guidance of project management process by the project manager	
7	Software change management according to project scope	
8	Team commitment to the project's success	**Commitment and collaboration of project team and customer**
9	Customer presence in project workspace	
10	Delivery phases of software over short periods regularly and orderly	
11	High priority to achieve customer satisfactionduring the project	
12	Customer working closely with the development team	
13	Sponsor or top management commitment	
14	Training required to systematically software implementation	
15	Communication and Team & Customer collaboration	**Requirement clarification and team & customer collaboration**
16	Information technology culture and belief in it	
17	Requirements to be well-defined by the customer	
18	Customer requirement clarification for technical team	
19	Small sized team (20 or smaller)	**Small team and appropriate tools**
20	Appropriate operating systems and tools	
21	Well-defined and standard programming	
22	Expertise in marketing and sales in project's team	**Appropriate marketing**
23	Well defined project scope and scheduling	
24	Well-defined scheduling and completion in specified time	
25	Competitor cognition	
26	Scientific marketing and sales	
27	Project team'smotivation to complete the project	**Learning and motivation team**
28	Project teams establishment in one place	
29	Learning culture	
30	Collaborative culture instead of hierarchy culture	**Culture and convenient workplace**
31	Oral culture with high value and face-to-face communication style	
32	Convenient workplace, without peripheral issues around the project team	
33	Reward system	

34	Coherent teamwork with collaborative organizing	**Coherent teamwork with good support**
35	Good support	
36	Encourage company to develop software accordance intellectual property law	
37	Expert existence in the customer's team	**Expert existence in technical's and customer's team**
38	Expert existence in technical's team	
39	Project team's technical competencies	**Project team's technical competencies and revenue assurance**
40	Important feature delivery to customer at first	
41	Revenue assurance	
42	Strong support from the CEO	**Strong support from the CEO and Avoid prolonged project**
43	Project failure due to prolongation of the project	
44	Coaching culture	**Coaching culture**

Conclusion and Discussion

The concepts offered by Porter (1985), Boehm and Papaccio (1988) which we mentioned above were used for analysis of components and combination of related components in qualitative-quantitative analyzing and factor analysis. Finally the effective and important components in exploitation of opportunities in software industry (Table 4) were classified.

Table 4: Final software value chain effective components

Infrastructure	
Strong support from the CEO and Avoid prolonged project	
Technology Development	
Small team and appropriate tools	
Service, Marketing & Sales	**Operations**
Appropriate marketing, Good support	*People Factors*
	Expert existence in technical's and customer's team
	Organisational Factors
	Learning and motivation team, Commitment and collaboration of project team and customer in convenient workplace
	Process Factors
	Project management, Requirement clarification,Revenue assurance

According to table 4, effective and important components in success and competitive advantage of software development industry are classified into 4 total categories. These dimensions include: infrastructure, technology development, operations, and services, marketing and sales. For having competitive advantage in the industry every company should compare the company's value chain with competitors from the point of these aspects and attend to differences and distinctiveness. The most important components are listed below in four sections and there are examined in terms of competitive advantage and cost.

In the infrastructure section, completion of project in specified time is one of the competitive advantages that can reduce costs. In technology development section,

appropriate and efficient tools can accelerate speed of project, cost reduction, and differentiation in quality that ultimately leads to increase competitive advantage compared to competitors. From the perspective of value chain analysis, technology development and infrastructure of company support two types of factors: 1) operations, 2) services, marketing and sales.

Firm infrastructure includes 8% of costs and technology development includes 3% of overall costs that for these sections instead of decreasing the costs there should be increase. Increasing costs in these sections leads to costs reduction in operations section that includes 80% of overall costs with respect to analysis of Boehm and Papaccio (1988).

Better and more services to customer lead to additional value creation and ultimately increasing competitive advantage for the company. The first goal of software manufacturers should be being a customer-oriented company in order to be a leader in finding a competitive advantage over competitors. Marketing and more sales mostly is related to buyer's value chain and can lead to increase company's competitive advantage compared to competitors.

In this paper, people, organisational and process factors are summarized in a category which is named operations, that indicates the close relationship of these factors in acquisition of competitive advantage. With respect to analysis of Boehm and Papaccio (1988), operations include 80% of overall costs in software developing, so cost reduction in this section can be one of the most important features of competitive advantage from the type of cost reduction strategy for the company.

Recommendation for Future Research

According to importance of marketing and services, the buyer’s value chain analysis and value added creations through buyer’s channel and investigation of effective factors in this value chain for increasing competitive advantage can be a good subject for future researches.

Also, according to importance of project management in Iran and results of factor analysis that shows project management has the most shares among components, investigating the influence rate of important and effective factors of project management and analyzing these factors to increase competitive advantages can be a good subject for softwarescholars and managers in Iran.

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