Foresight International Seminar:

From theory to practice

Centro de Gestão e Estudos Estratégicos
Ciência, Tecnologia e Inovação

Center for Strategic Studies and Management
Science, Technology & Innovation

Foresight International Seminar

from theory to practice

Brasília – DF
2011

ISBN 978-85-60755-43-1

Social Organization supervised by the Brazilian Ministry of Science, Technology and Innovation (MCTI)

Editor | *Tatiana de Carvalho Pires*
Graphic Design | *Eduardo Oliveira*
Front cover and diagramation | *Marjorie Amy Yamada*

Cataloging in publication

C389r
Foresight International Seminar: from theory to practice. – Brasília, DF: Center for Strategic Studies and Management (CGEE), 2011.

176 p.; il, 24 cm

1. Foresight studies. 2. Foresight process. 3. Text mining. 4. Roadmap. I. CGEE. II. Title.

CDU 001.89

Center for Strategic Studies and Management
SCN Qd 2, Bl. A, Ed. Corporate Financial Center Room 1102
70712-900 - Brasília, DF
Telephone: (005561) 3424.9600
http://www.cgee.org.br

This publication is part of the activities carried out under the Management Agreement No. 2 CGEE - 1st Addendum / Action: Discussion Forums in ST&I - subaction: International High-Level Meeting - 53.5.4/MCTI/2010.

Print in 2011.

Foresight International Seminar:
from theory to practice

Supervision
Marcio de Miranda Santos

CGEE technical team
Claudio Chauke Nehme
Lelio Fellows Filho

Summary

Anexxes

Presentation

The book you are about to read is the result of an effort undertook by CGEE to bring Brazilian nationals and experts from other countries with the aim of exchanging concepts, views and practices when assisting in decision-making processes on science, technology development and innovation.

It couldn't be better. Leading scholars and practitioners met at CGEE premises and freely debated the advances in foresight with several S&T Brazilian institutions and representatives from government and the private sector. At that informal meeting, a range of issues on how to approach future challenges and their impact on daily life were presented and discussed using state-of-the-art methods and tools.

CGEE is very thankful to those who attended. Special thanks go to the specialists coming from different locations in Brazil and to those from Argentina, Australia, Peru, Thailand, the USA and Sweden, who dedicated a couple of days from their busy schedule to be with us. It is also my pleasure to acknowledge the superb job of the local organizing committee, led by Claudio Chauke and Lelio Fellows Filho, with the support of our event coordination, publications and administrative teams.

We do hope that readers will enjoy, this publication compiled by the Center's technical staff. You may also access the presentations from the event by visiting our web site at *www.cgee.org.br*. We expect to repeat this exercise every now and then and we will knock on your doors again in the near future. We wish you good reading.

Marcio de Miranda Santos
Executive Director CGEE

Foresight promotion in Latin America: the Peruvian case

Fernando Ortega San Martin*

First at all, let me thank CGEE for the invitation to this seminar. In this article, I will present the modest experience developed in my country, Peru, of the promotion of foresight activities since the year 2000 until now, as well as the troubles we have faced and the successes we have achieved during the process of introducing Foresight in our country, situations that may be extrapolated very well to other countries in Latin America.

Let me start this article with the History of Future Studies in my country.

Background of future studies in Peru

In Peru, as in other cradles of human civilization, concern about knowing the future began very early from the first manifestations of the culture, 5,000 years before Christ.

Andean people developed different procedures and rituals to extract information about the future from their Gods. They used to read the fate from the entrails of animals, as llamas, alpacas or condors, during main religious ceremonies.

But, the most used practice was reading coca leaves , and it is still carried out by shamans and sorcerers every day, in typical local markets , mainly in the Highlands, although it is not surprising to find such practices in modern cities like Lima.

Peruvians also used to consult oracles. The most famous was the god Pachacamac's oracle, whose temple was located 20 km. south of the current city of Lima. The name "Pachacamac" means "The One who generates the world" in Quechua language, and the wooden idol representing the god has two faces looking in opposite directions: one looking into the past and the other into the future.

* Associated Professor and researcher on foresight of the Engineering School at University of Lima (Peru). Former Secretary General at National Science, Technology and Technological Innovation Council of Peru (Concytec). Currently, Director of Foresight and Technological Innovation at Concytec.

Going on to modern times, I think it is necessary to recognize the pioneering work of two important peruvian economists, Claudio Herzka and Helan Jaworski, the latter recently deceased. They introduced future studies during the eighties, using mainly forecasting methods.

Unfortunately, since it has happened in all Latin America countries, the widely spread habit of using the American method of strategic planning prevented the development of future studies in Peru up until the end of century.

The main troubles

What were the main troubles we faced to promote foresight in Peru, which ones were similar to the rest of Latin America? They were many, but they can be summarized in these four:

- Lack of national experience of long-term thinking. We must admit that our countries think more about the short term than the long term, especially our politicians and many entrepreneurs.
- Excessive trust of the Strategic Planning American method: private and public planners recite from memory the chain: "vision-mission-objectives-goals-strategies-activities". It is very difficult for us to understand and explain why they still continue to use a method created in the early sixties to face the challenges of the twenty first century.
- Almost complete ignorance of Foresight as a planning tool. The french prospective was introduced in Latin America in the eighties by young professionals from Argentina, Mexico, Colombia, and Brazil, who studied in France and came back to their countries in those years when democracy returned to our region.
- Huge inertia and resistance to change in Latin American society (government, academia and private sector). People resist change when they perceive it as a threat to their current relations of power. It is difficult for them to identify the opportunities that change brings with it.

The strategy

In order to overcome these challenges, we followed a strategy composed of three steps:

1. First at all, we decided to promote foresight throughout the country, because "nobody uses what they do not know".
2. The second action that we proposed was to train the greatest number of Peruvian professionals in the use of foresight.

3. The third action that we proposed was to establish a national legislation forcing the use of foresight in the planning process of the public sector.

With these three elements (promotion + training + legislation), we expected to begin to see the frequent use of foresight in the country.

So, we started foresight promotion activities in 2000, thanks to the UNIDO Program for Latin American and Caribbean countries, which began in 1998. Unfortunately, Peru joined the program too late at this point the available resources were already scarce.

However, the first seminar was able to be organized with the participation of Jesus Rodriguez Cortezo from OPTI (Spain) and Carlos Cristo from MDIC (Brazil) in Lima. We used material from this seminar to organize local events in order to diffuse Foresight in other parts of the country. Peru owes much to these two experts who taught us the value of Foresight as a planning tool for 21st century.

Afterwards, also thanks to the Unido, we organized the first Foresight Training Workshop in 2001, conducted by two venezuelan experts, Yuli Villarroel and Jesús Arape. This workshop allowed us to have the first generation of 25 foresight practitioners, but just a fourth of them continued working in the field of foresight. What was the reason? The answer is simple: Resistance to change, since most preferred the traditional use of Strategic Planning. They resigned the complex thought, preferring to work with a single vision instead of many scenarios.

We understood that we had to generate a new, powerful mechanism of promotion which would be able to convince the Peruvian society of the advantages of using Foresight instead of other planning tools.

This was how the Prospecta Peru Congresses were born in 2003. Since then, the Prospecta Peru Congresses have become the most important periodic events of foresight in Latin America, mainly by the high quality of guest speakers who attend the Prospecta Peru each year.

We can proudly say that the world's leading foresight experts have participated in the Prospecta Peru. Some of them were speakers from the International Seminar organized by the CGEE: Dr. Ron Johnston, Lelio Fellows Filho, and Gilda Massari Coelho. We appreciate their contribution to foresight development in Peru and Latin America.

The success of the Prospecta Peru Congresses encouraged many peruvian professionals train in foresight. More than 2,000 government officials, businessmen, executives, armed forces, police

officers, consultants, researchers and academics have received foresight training from 2001 to now, by means of workshops mainly organized by Concytec.

The last component of our strategy was more difficult to achieve: which was that Peruvian Parliament needed to approve a law that forced institutions of government to use foresight in their planning processes. But, we took advantage of the government's decision to establish a new National Planning Entity. We were able to convince lawmakers of the utility of foresight and, in 2005, they approved the law 28522, by which the National Center for Strategic Planning (Ceplan) was created, clearly indicating, from that moment on, planning in Peru should be done using foresight tools.

Nevertheless, Ceplan's first works have used very little foresight, because of the inertia in the continued use of Strategic Planning we mentioned before. We hope that gradually the foresight approach will be used more often.

If we identified the paradigm of excellence of strategic planning as a planning tool to be the main problem of foresight diffusion in Latin America, the question we ask ourselves is: What can we do to achieve a transition from Strategic Planning to Foresight without hurting anyone along the way?

We knew that people had the habit of having a Vision. The general idea of the organization is "without vision we do not have anything". Every organization has a vision hanging on the wall of the entrance hall. So, we understood that the best way to gradually replace the use of Strategic Planning by foresight was to help people transform their vision into a scenario-goal, produced by the use of foresight as a starting point for the strategic work of the organizations.

We did a search within the specialized literature of foresight tools, and we could not find a methodological tool able to be completely adapted to our particular needs. So, we decided to create a new tool, taking components of many well-known tools, and adapting them to the peruvian reality, which is not very different from the ones throughout Latin America. So, the Challenging Future Method (CFM) was born.

The CFM process is very simple, we take the vision from Strategic Planning, which is generally a very utopist and optimist image of the future, and for this reason, it is very hard to produce realistic strategies. So, we need to see the vision as it is, a great challenge (organizational, national, territorial) and in facing it, we need to break this great challenge in several minor challenges, called Challenging Futures, making the vision easier to analyze and confront.

Each Challenging Future is formed by several drivers, but just some of them are shared by different Challenging Futures. We consider these shared drivers as key drivers and we use them to build scenarios, and from all of the identified scenarios, we choose the scenario-goal.

The CFM conceptual framework is based on the theory of dissent, the philosophical approach proposed by french thinkers during the sixties and seventies, as a way to rescue the opinion of minorities, the neglected or the marginalized, during the process of consensus building.

Usually, we think that consensus is synonymous with truth. That is not always true. During eighteenth century, slavery was a common consensus everywhere, but nonetheless, some people wanted to abolish it and they were persecuted and imprisoned. The marginal people of yesterday may be the consensus in the future.

The complete CFM process may be seen in the Figure 1.

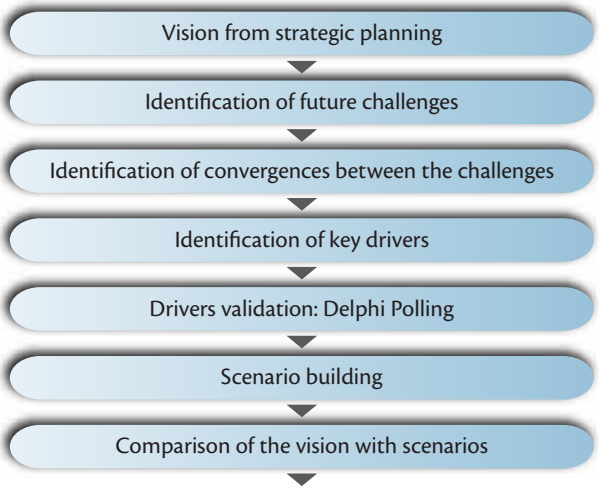


Figure 1. CFM process.

Now, we will explain the CFM process step by step:

Step 1

The starting point is the vision, resulting from traditional strategic planning. Usually, the vision from SP is an idealist image of future, with little possibility to be reached. This is the

reason in which the vision is not useful for real planning processes in public institutions and/or private organizations.

Step 2

The vision must be divided into challenges. Each vision involves the fulfillment of many challenges. Often, those who formulate the vision ignore the need to overcome many challenges in order to reach it. Identifying the challenges helps to recognize the necessary hard work to reach the vision initially formulated. The number of challenges should be around 10, though they might be much more, but they must all be born from the text of the Vision resulting from Strategic Planning. Each challenge is formed by drivers or variables of change. The next step is to identify all the relevant drivers of each challenge.

Step 3

Although each Challenging Future is very different from each other, if we break down each Challenging Future in their "future generator drivers", we will find that some drivers participate in many different Challenging Futures. The repeating drivers should be considered as "key drivers" and used in further processes of scenario building. "Key drivers" identification may be seen at the Figure 2.

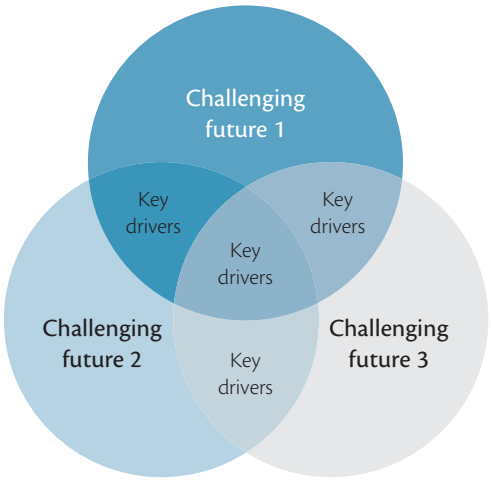


Figure 2. Identification of key drivers.

Step 4

Once the key drivers are identified, it is necessary to analyze their hypothesis or options of future and other relevant information with the aim of characterizing them. In order to have a similar structure for each identified driver, we can use the following pattern:

Driver's name	
Hypothesis of future (movements, options or freedom grades)	1. 2. 3.
Indicator	

Step 5

If we have enough financial resources and time, we could validate the key drivers by means of Delphi Polling. There are many different ways to structure a Delphi questionnaire, but we prefer to use the following model:

Assessment	Importance			Expertise auto-evaluation			Time during which the event will happen						
	High	Medium	Low	High	Medium	Low	Already happe-ned	2011–2013	2014–2016	2017–2019	2020–2022	Over 2022	Never

Step 6

With the drivers who passed the validation process, we can start scenario building. For that, we can use any of the different variants of the scenario building process. We prefer the use of Schwartz axis (Figure 3):

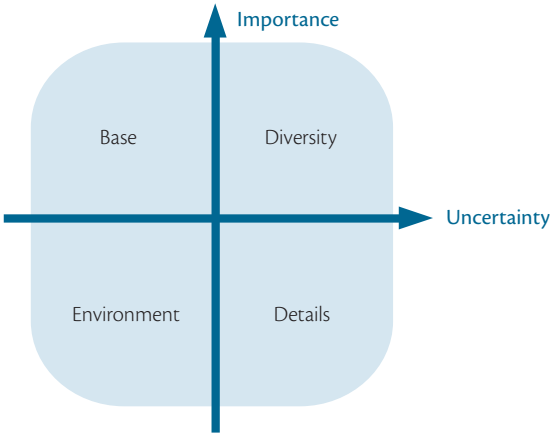


Figure 3. Schwartz axis.

The CFM method was applied for the first time in two rather different situations:

1. To identify national scenarios for 2021: a study conducted by the IPAE (Peruvian Institute of Business Action) in 2008.
2. To identify a regional scenario-goal for 2021: a study conducted by the Regional Government of La Libertad in 2009.

IPAE's Foresight exercise for 2021 Peru Scenarios was made for the CADE 2008 (Executive's Annual Conference), the most important businessmen event in Peru.

Thanks to use of the CFM method, 29 strategic challenges in Peru's future in 2021 were identified.

When the process finished, four scenarios were identified:

1. Peru is advancing, but not as fast as it could.
2. The economy is growing, but not enough.
3. Peru is en route to becoming a first world country.
4. Peru may be heading for disaster.

The results of this exercise can be downloaded from:
http://www.ipae.pe/aportalv22/flashcee/CdnosCEE-03_Escenarios_Peru_2021.pdf

Likewise, this method was used for a second time by a Regional Foresight Exercise performed by the Regional Government of La Libertad, the third Peruvian Territory according to its contribution to GNP. The decision to use the Foresight approach within its Planning Process was taken by the Regional President, who attended the 2008 Prospecta Peru Congress, held in Trujillo, the capital city of La Libertad Region.

This exercise served to modify the former Regional vision obtained by traditional Strategic Planning. You can see the difference:

Vision from strategic planning	Scenario-goal from CFM
"In 2021, La Libertad Region (LLR) institutions counts on people with service vocation and a culture of ethical values, and their leaders are fulfilled with regional development. LLR population lives in decent houses with regular access to public services (water supply, waste management, energy, telecommunications, and so on). LLR population has a high environmental conscience. All water sources and forests are protected, and all economic activities are performed in complete harmony with the environment. LLR has eradicated extreme poverty and all people enjoy the same opportunities without restrictions of gender, age, race, religion or physical condition. LLR population has universal access to high quality education and health services. LLR farming is competitive, technologically modern and organized. LLR SMEs are formalized, integrated into clusters and articulated to national and international trade flows..."	"In 2021, LLR counts on at least 70% of its organizations to be reinforced,trained, and working in permanent interaction and communication, and generating positive integration. 80% of the education and health institutions will operate within the national quality standards. 60% of the rural-urban education gap will be reduced. More than 50% of small farmers will be integrated to value chains for export and national consumption. More than 50% of local SMEs will be integrated into clusters for export and the national market. All regional roads will be asphalt covered and all district capitals will be integrated to vial regional structure. LLR will have an international port and an airport operating at competitive conditions..."

The Scenario-Goal obtained by the use of the CFM method has served La Libertad Regional Government to formulate its Regional Development Plan for 2011-2021 period.

Conclusions

The Peruvian experience has demonstrated that the introduction of foresight in Latin American is not an easy job. For this reason, the main recommendation we have is to identify sectors, activities and/or territories where social actors are encouraged to try different and alternative ways to the traditional Strategic Planning method, the complexity and uncertainty of current times have increased immensely in the last thirty years, and they need more useful and modern tools to identify opportunities and/or threats.

Training researchers, consultants, government officials, executives and businessmen on foresight should be the first investment of any country wishing to face the challenges of the 21st century.

The development and the use of new methods, like CFM, based on the adaptation of well known foresight tools, particularly in Latin American reality, is a good option for facilitating the diffusion of foresight in our countries.

The application of information and knowledge management tools: using text mining in foresight studies

*Gilda Massari Coelho**

Introduction

The utilization of prospective methods and support techniques for decision-making in establishing Science, Technology and Innovation (ST&I) policies has increased in Brazil over the last five years. It is the result of profound changes in the country and abroad, particularly regarding aspects related to the globalization of the economy and the acceleration of technological changes, which make it obligatory for Brazil to reach higher levels of development in the areas of ST&I. The capacity to foresee the future has become an element of extreme importance in order to increase the competitiveness of Brazilian businesses and the country itself.

The exercises of exploring the future are considered important for strategic planning, supporting decision-making and for the formulation of public policies, for they allow to foresee breakthroughs, technology leaps, trends and discontinuities, new perspectives and maps of opportunities.

Many new methods, techniques and tools currently used in prospective studies resulted from advances in information technology and information science. Among them, we can highlight scientometrics and bibliometrics, traditionally used by information science to measure the scientific productivity and identify networks of cooperation in science and technology. The advent of information resources in electronic format, widely accessible, changed the efforts of information gathering and analyzing, making it possible to process large amounts of information easily and effectively. (COELHO & SILVA, 2003)

Today, both techniques, embodied in text mining tools, are used in future studies, together with a combination of machine learning, statistical analysis, modeling techniques and database technology

* Center for Strategic Studies and Management (CGEE), Adviser.

to find patterns and subtle relationships in data and infer rules that allow identification of future trends. It represents the possibility of mining data in order to gather strategic information in thousands or millions of sources. (PORTER & CUNNINGHAM, 2005)

This paper presents the text mining technique and how it is used at the Center for Strategic Studies and Management (CGEE) in its prospective studies, including some results of its application.

Text mining

One of the greatest challenges we face developing prospective studies is dealing with too much data. Besides that, we need to take into account the changing nature of technological change and innovation, which is increasingly science-based (e.g., bio, nano), has broadening concerns (e.g., competitiveness, sustainability, social development), must give renewed attention to societal outcomes (e.g., sustainability), have capability to address complexity in technological innovation systems and deal with discontinuous advances and radical innovation. (PORTER, 2009)

In the age of too much information, we need to treat text as data to gain intelligence, mining ST&I information resources to answer questions. This challenges all those who are involved with management of technology – from researchers to managers – to grasp advances and changes in their own fields of expertise. It makes it necessary that we apply emerging analytical tools to "mine" this information to inform our analyses. And we must digest enormous amounts of available information, do so rapidly, present findings vividly and understandably. (Porter, 2009). Given the huge amount of information available in textual format, humans are not capable of processing (ie, read and assimilate) all that information.

Data mining, according to Porter (2005), seeks to extract useful information from any data type, but common usage emphasizes numeric data analysis. Text mining, on the other hand, exploits text sources of various sorts. Known also as Knowledge Discovery from Text (KDT), it refers to the process of extracting useful information from text documents by identifying and exploiting patterns. It represents an opportunity to exploit electronic informational resources and incorporate them in foresight studies.

The Gartner Group (2010) defines text mining as the process of discovering meaningful correlations, patterns and trends by sifting through large amounts of data stored in repositories. It employs pattern recognition technologies, as well as statistical and mathematical techniques.

The use of text mining, therefore, is appropriate when a pattern and not a specific document is needed. Particularly in relation to the analysis of texts, it is important to remember that there are tools that address unstructured textual sources (as contents of Internet sites) and structured textual sources (databases that separate the data into fields like author, title, keywords, etc.). Text mining can also be considered a form of content analysis allowing, for example, the identification of patterns in the use of terms to infer the emphasis of certain areas of technology.

Including text mining in prospective studies is a primary requirement for this type of activity. Any organization operating in competitive and collaborative environments needs to track information about external technological developments. This represents incorporating technological intelligence, mining it from external sources. Some possible objectives of text mining include:

- Identification of scientific, technical or socio-economic events that are important for the organization.
- Identification of potential threats to the organization or industry, implicit in these events.
- Identification of opportunities for the organization or industry and changes in the environment.
- Alert on trends that are converging, diverging, expanding, reducing or interacting.

According to Porter and Cunningham [2005], "social scientists have applied methods of contents analysis for decades. Counting scientific publication activity dates back at least to the pioneering work of Derek de Solla Price (1963)... With the advent of electronic text sources and analytical software, content analysis has matured into text mining...".

One of the most important aspects of bibliometric analysis is that it goes beyond the experts' biases, allowing the discovery of new facts and patterns that sometimes are not perceived due to the limit of knowledge or preconceived visions. Some authors point out certain limitations of bibliometric analysis (PORTER & DETAMPEL, 1995; PORTER, 1998), considering that not all R&D activities are published or patented: much of the activity of technological development is not included in a timely fashion either in journals, conferences, papers or patents; counting publications does not distinguish the quality from its content; each institution has its own patenting policy; and there is no perfect system of classification and indexation of publications.

The use of article and patent databases as a source of ST&I prospective studies is based on the assumption that increased interest in new technologies will be reflected in increasing activity of R&D and that, in turn, will be reflected in the increase in articles, publications and patent applications.

Therefore, it is presumed to be possible to identify, for example, new technologies by examining the patterns of patent applications in certain areas of knowledge. The logic behind this is based on the so-called R&D life cycle, presented in Figure 1: in stage 1, there are few publications; it increases during stages 2 and 3; and decreases during stage 4. The results of the findings are often presented in a quantified way, but its use in decision making is based on a qualitative assessment.

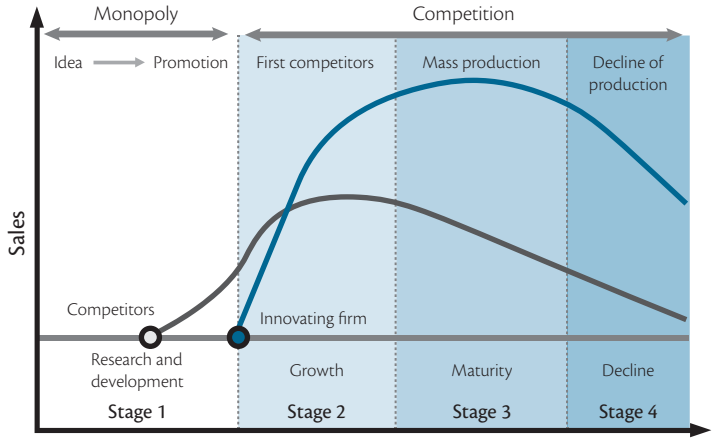


Figure 1. R&D life cycle (Porter, 2009)

The usual flow for a text mining study, as presented in Figure 2, includes in general:

- Clear identification of the purpose of data gathering.
- Selection of reliable sources, including Internet and commercial databases.
- Elaboration of search strategy.
- Access to national and international databases that enable the needed data recovery.
- Downloading of recovered data.
- Evaluation of the quality and comprehensiveness of the collected data.
- Reformatting data, when needed.
- Content analysis with text mining tools.

It is possible, then, to generate the preliminary reports, analyze its results, and elaborate the final report.

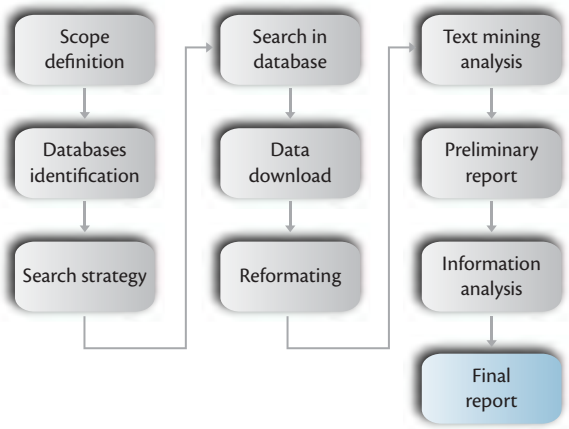


Figure 2. Text mining flow

How to obtain good results with text mining

Considering the benefits and limitations mentioned above, there are some essential points for obtaining good results in text mining (COELHO & SILVA, 2003):

- Knowledge of the subject being studied: it is important to have a good knowledge of the subject to define the search strategy in databases and analyze its results.
- Knowledge of the databases to be used: to know their contents and their structure, their level of standardization and the existing possibilities of data recovery are factors that define the success or failure of the task. The lack of standardization, for example, sometimes makes good text mining impossible due to a lack of trust in the data.
- Knowledge of patent information: if the patent is being studied, it is important to know about the patent information structure, since they have their own rules. According to Dou et al (2004), the field of patents is extensive, where techniques, products, applications and legal considerations are strongly mixed. This is also a field that is dedicated most of the time to people of industry and, for example, the academic community does not cite patents very often. Nevertheless, patents are a unique source of information since most of the data and information published in patents are not published elsewhere.
- Definition of search strategy: it is an essential step and it is linked to the three previous ones, that is, knowledge of the subject and knowledge of databases and patents. The use of restricted or extremely ample terms, for example, can lead to results that induce errors of evaluation.

- Usage of analytical tools: it is important to have good text mining software and also to really know how to use it. Some commercial databases are beginning to provide analytical tools together with the search facilities, but they still have limited possibilities.
- Result analysis: experts must analyze the results by trying to extract the best interpretation of the histograms, matrices and networks to looki for strategic information.

The usage of text mining techniques must, necessarily, involve the experience of information professionals and of domain experts in order to be successful. The knowledge of information professionals on the available information sources, their content and structure, and the opinion of experts to define the search strategy and to interpret the results are crucial for the quality of the final work.

Text mining information sources and tools

Text mining means searching through the technical, trade and business literature to identify events that may foretell significant later developments. Using the so-called innovation cycle, Figure 3 (adapted from MARTINO, 2003) presents some examples of databases that can be used depending on the R&D stage.

The planning of data gathering is an important step, since the existing information about the topic or about the experts who work in the area are essential to the achievement of the study and contribute greatly to the initial views on the subject.

When it comes to collecting information to use for monitoring a given area (as in text mining), it is necessary to initiate with very comprehensive searches to enable the retrieval of data at various levels, both already established and those representing new areas.

Life cycle – Sources

R&D phase	Sources	Content focus
Basic research	Web of science	Articles – Science
Applied research	Engineering index	Articles – Engineering
Technology development	Derwent patents	Patents – Technology
Application	ABI inform	News – Market
Impacts	Newspapers; business journals	News – Social

Figure 3. Sources for R&D life cycle data (Adapted from MARTINO, 2003)

The next items present a brief description of the databases and text mining tools that the CGEE has been using in its studies.

Web of Science

The Web of Science is a multidisciplinary database, indexing only the most cited journals in their respective areas. It is also an index of citations, stating, for each article, both the documents it cited and the documents that quoted it.

It contains more than 36 million records. Each year, over 1.5 million records are added as well as over 23 million cited references in over 230 disciplines in the sciences, social sciences, arts and humanities. It includes full bibliographic information, indexes for 9,200 journals and it is updated weekly.

Derwent Innovations Index

Derwent Innovations Index (DII) has data on patents application in 40 countries and gives a comprehensive view of the global market in chemical engineering, electrical, electronics and mechanics. Coding and additional descriptive information allows users to identify the importance of a patent and its relationship to other patents. Users can perform searches of patents and citations, without the need of an expert in patent searching.

Patents are an essential source of information, either by their functions of technological heritage, protection, identification and knowledge of technologies developed by companies or for information on technologies and their applications. It is a unique source of information because most of the data and information published in them are not available anywhere else.

A patent is usually the first time that a new technology is brought formally to the public, when the inventor seeks legal protection for his invention. The time from when the deposit is requested to the actual marketing of a new technology can be months or years, which gives patent analysis the ability to project future technological trends. Some of the usages of patents as an information source to help identify technological trends are:

- Products / technologies life cycle
- Identification of emerging technologies
- Identification of alternative technologies
- Identification of players (companies, experts)

- Corporations' legal policies
- Research potential / Identification of new fields of research
- Experts / Business Networks
- Potential partners or competitors
- New market entrants
- Present or future business leaders

Text mining software

There are different kinds of software that are commercially available that allow for the statistical treatment of any set of retrieved information into bibliographic databases. These different kinds of software are based on bibliometric principles and are appropriate for automatic analysis of structured information: a bibliographical reference is formed by the set of elements that constitute it, containing specific information in diverse fields, like title, institution, country, keywords, classification, and sources, among others.

Thus, it is possible for a given set of references or records, separating all the elements that constitute it, to calculate the frequency of these elements and to store the data of the references to which they belong to.

You can then bring them together in various combinations (networking, matrix etc.), allowing the order of frequency to be known, which companies operate in that area, and who are the inventors and the subjects. You can move on to more complicated correlations, for example, groupings of companies whose activity is similar.

Text mining software like Vantage Point[1] and Matheo Patent / Analyzer[2], among others, is based on bibliometric principles and is suitable for automatic analysis of structured data. These tools aim to treat large amounts of data, prepare tables, graphs and maps that facilitate the task of the analyst and expedite the transformation data into information and intelligence. Its parameters include:

- Association – looking for patterns where one event is connected to another event
- Sequence or path analysis – looking for patterns where one event leads to another later event
- Classification – looking for new patterns

1 See Search Technologies at: *http://www.thevantagepoint.com/*

2 See Information Management Consulting & Solutions at: *http://www.imcsline.com/*

- Clustering – finding and visually documenting groups of facts not previously known
- Forecasting – discovering patterns in data that can lead to reasonable views of trends about the future.

The resulting analysis can provide information on emerging technology, who's doing what, to map out how subtopics are interrelated and perform analysis of trends in publications, patents, citations, as well as immediate answers to a series of issues related to technology management.

CGEE's methodological approach and the usage of text mining

The logic behind the development of the CGEE's methodological approach – strategic foresight – is that its structure is based on the perception that decision-making emerges from negotiation between multiple players. This is a key point for "foresight", which can be defined as "a process by which a more complete understanding of the forces that shape the future can be obtained and should be taken into consideration in the formulation of policies and in the planning of decision-making" (MARTIN, apud CUHLS and GRUPP 2001). It is important to emphasize that foresight is a process rather than a set of techniques (MARTIN 2010).

This approach seeks to provide a strategic perspective for the present, with knowledge about future possibilities, building commitment and coordination on national or institutional priorities. Foresight is a way of thinking about the future based on action and not on predetermination. It includes qualitative and quantitative methods, and seeks a shared vision of the future and the promotion of actions and facts that are intended to promote its construction in the present.

The CGEE considers that each foresight exercise must be customized and its methodological approach must be adapted to the needs of its customers, using a variety of methods, techniques and tools available today. The use of different methods, techniques and tools is one of the main characteristics of current future studies, as highlighted by Porter et al (2002) and Popper (2008).

One of the guiding principles of future studies conducted by the CGEE and which constitutes one of the fundamental elements of its methodological approach is:

- It is based on data, but intensively incorporates the perceptions of different players interacting with the topic of study, be it a business, an industry or an area of knowledge.
- We consider that it is necessary to forecast and carefully consider the existing data, but it is also necessary to incorporate, in our visions for the future, human perceptions of the world.

The CGEE methodology includes the use of text mining as a tool to map a given area or to identify trends. It is mostly used in the initial phase of the process, where there is a need to have a good knowledge of the subject and bring up new questions.

Figure 4 presents the CGEE's methodological approach, highlighting the initial phase, where text mining techniques are used.

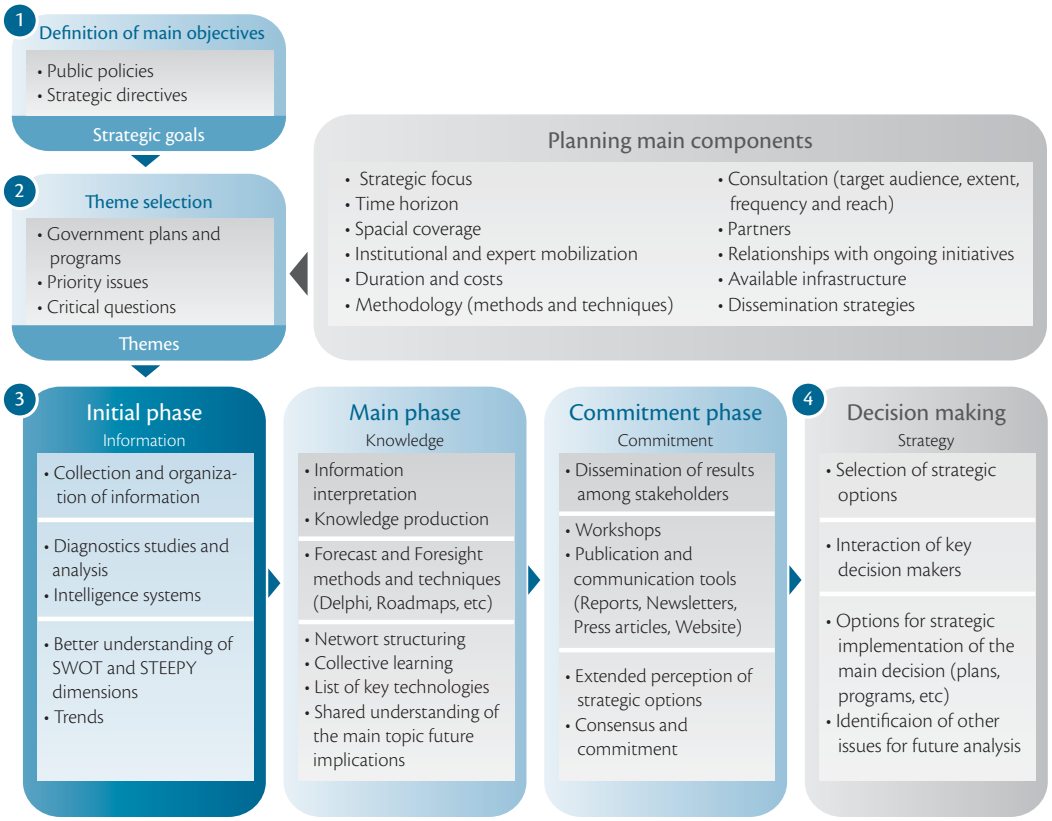


Figure 4. The CGEE's methodological approach

The CGEE's methodological approach: initial phase

The initial phase in the CGEE's methodological approach corresponds to the identification of the current situation, and involves the collection, organization and summary of the available information on the theme or subject under analysis, using for this purpose studies, diagnosis, analyses and intelligence systems in order to have a better understanding of the problem. It means the collection and analysis of the explicit knowledge available. The question here is: What it is happening?

Elements that can potentially impact the theme/subject being study are identified and delimited as opportunities and threats, forces and weaknesses, and cultural, social, technological, economic, political and environmental factors. In a complementary way, the experts and other stakeholders are identified and mobilized. (Figure 5, CHAUKE-NEHME et al., 2009)

In this phase, to obtain a panorama of the current situation, the CGEE uses different techniques and methods in its studies. The choice of the method or technique is made in accordance with the subject and the objectives of the study. In general, more than one technique or method is used, to obtain different or complementary visions of the same subject. It is in this stage that text mining is used.

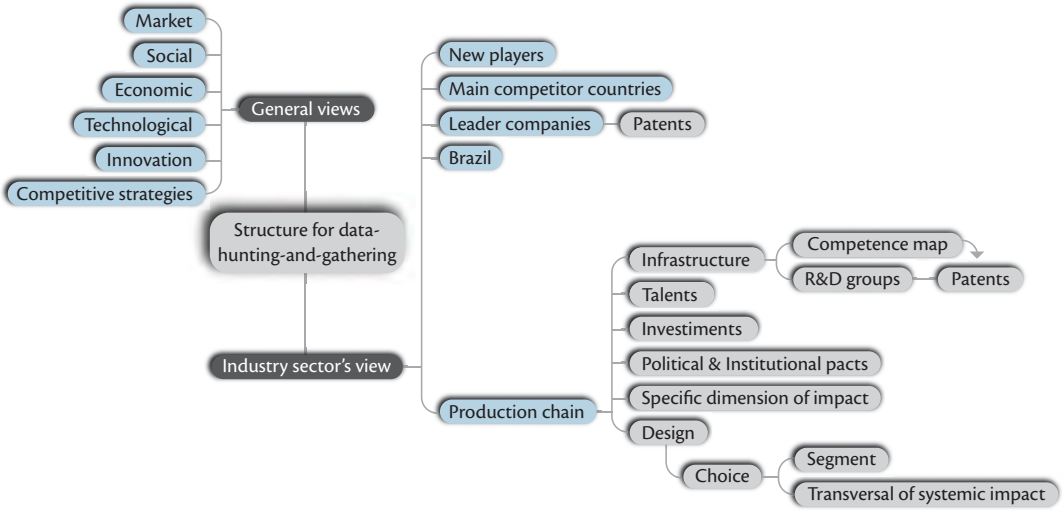


Figure 5. The framework for data-hunting and -gathering

Using text mining in CGEE's studies: some examples

Three text mining applications in CGEE's studies are presented below. They are simple examples of some of the results obtained through information analysis based on the studies of nanotechnology, the footwear industry and medical equipment.

Figure 6, from the study on nanotechnology (SANTOS et al, 2006), presents how research activities stand, in global terms. Although some of these categories are hard to distinguish from each other, this categorization helped to identify the most used denominations and gave input to other studies on the subject, carried out by the CGEE.

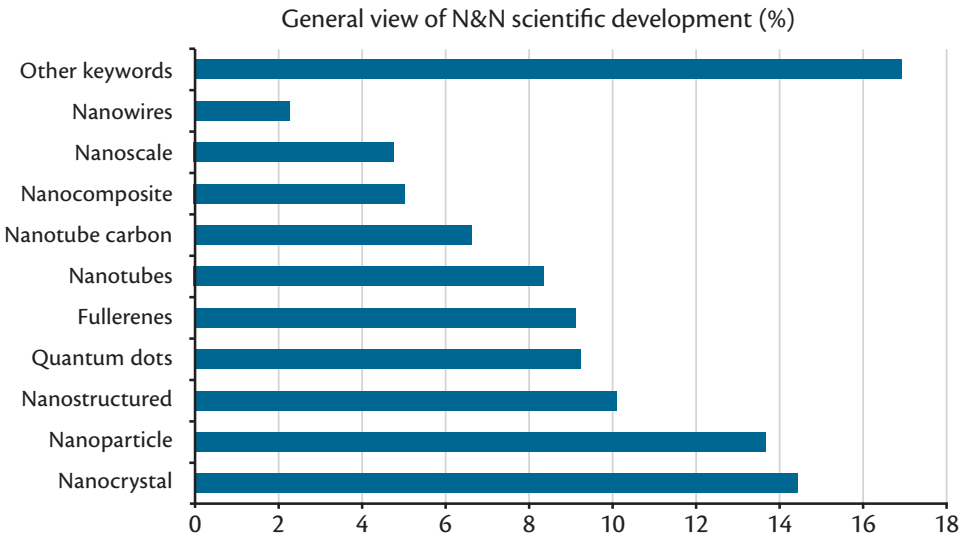


Figure 6. General view of N&N scientific development – 1994/2004

Figure 7, from the study on medical equipment, represents a thematic cluster map, using the international patent classification code, showing the links between different technological developments.

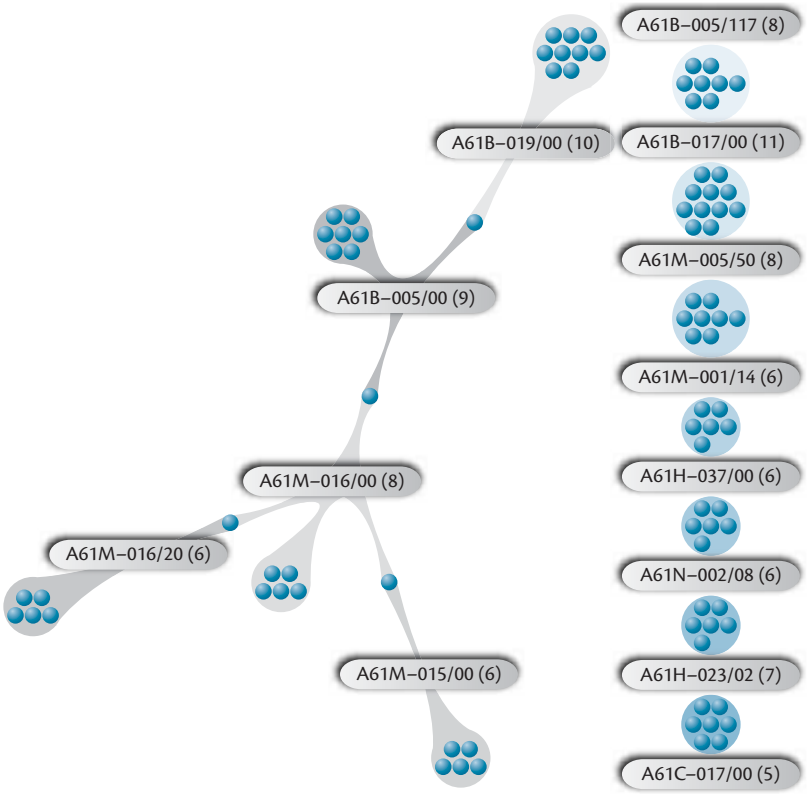


Figure 7. Medical equipment - Thematic cluster map using patent classification

Figure 8, from the study of the footwear industry, makes a comparison between the evolution of technological developments worldwide and in Brazil and other competing countries.

Brazil

Qde. de depósitos	Inventor	Depositante
9	Schenkel D. L.	Calçados Azaléia
		Artecola Indústrias Químicas
9	Kunst E. R.	Ltda
6	Matsuo E.	Grendene S/A
4	Cintra U. F.	Individual
4	Dal Magro V. T.	Grendene
4	Gruen L.	Individual
4	Zini A. P.	Máquinas SAZI Ltda

Figure 8. Footwear industry - Technological evolution in selected countries

Conclusions

The creation of visions of the future to anticipate emergent opportunities, potential threats and to indicate trends and priorities is vital to the success of the ST&I process. This requires permanent monitoring of the environment and refinement of perceptions of the impacts of a given decision for the future of nations and companies.

Data and text mining used in those activities are useful and important tools for the automatic analysis of large amounts of data. Some caution, however, must be taken in its use, for example, the correct choice of the source of information to be used, the search strategy and the integration of information professionals and experts in the area to be studied. The efficient choice and use of different techniques stand out as vital to comply with problem specifics.

Kostoff et al. (2000) point out that "the maximum potential of the DT (data tomography) and bibliometrics combination can be achieved when these two approaches are combined with expert analysis of selected portions of the database." The CGEE's experience shows that including expert opinion is essential to obtain good results.

Emphasis on participatory approaches and the establishment of communication networks, with both horizontal and vertical communication channels, together with quantitative methods like text mining, helps to reduce the risk of developing biased views.

Another important point relates to the need to create new tools and approaches that can deal with multidisciplinarity. Methodological flexibility is necessary to address the increased complexity of themes associated with the innovation process.

References

ARAÚJO, C. A. Bibliometria: evolução histórica e questões atuais. *Em Questão*, Porto Alegre, v. 12, n. 1, p. 11-32, jan./jun. 2006.

CHAUKE-NEHME, C.; GALVAO, A. B; VAZ, A.; COELHO, G. M.; FELLOWS FILHO, L. Foresight: proposta de uma metodologia visando ao fortalecimento da competitividade dos setores industriais brasileiros. *Parcerias Estratégicas*, v.14, n.29, p.7-20, jul./dez. 2009.

COELHO, G. M. *Relatório Final: abordagem metodológica para o PES*. Brasília: CGEE, 2009.

COELHO, G. M.; SILVA, C. H. Prospecção tecnológica em patentes no setor de óleo e gás. In: WORKSHOP BRASILEIRO DE INTELIGÊNCIA COMPETITIVA E GESTÃO DO CONHECIMENTO, 4. Salvador, 2003. *Trabalho apresentado*... Salvador, 2003.

CONWAY, M.; VOROS, J. *Implementing organizational foresight: a case study in learning from the future, in probing the future: developing organizational foresight in the knowledge economy*. 2002.

CUHLS, K.; GRUPP, H. Alemanha: abordagens prospectivas nacionais. *Parcerias Estratégicas* n. 10, p. 76-104, 2001.

DOU, H.; DOU JR, J. M.; MANINNA, B.; COELHO, G. M. Análise de patentes visando a competitividade tecnológica e a inovação. *KMBrasil*, São Paulo, 2004.

GARTNER GROUP. *IT definitions and glossary*. Disponível em: *http://www.gartner.com/technology/research/it-glossary*. Acesso em 02/12/2010.

GUEDES, V. L. S. & BORSCHIVER, S. *Bibliometria: uma ferramenta estatística para a gestão da informação e do conhecimento, em sistemas de informação, de comunicação e de avaliação científica e tecnológica*. Disponível em: *http://dici.ibict.br/archive/00000508/01/VaniaLSGuedes.pdf*. Acesso em: 23/02/2010.

KOSTOFF, R.N.; BRAUN, T.; SCHUBERT, A.; TOOTHMAN, D.R.; HUMENIK, J.A. Fullerene data mining using bibliometrics and database tomography. *Journal of Chemical Information and Computer Science*, v. 40, n.1, p.19-39, 2000.

MARTIN, B. R. The origins of the concept of foresight in science and technology: an insider's perspective. *Technological Forecasting & Social Change*, n. 77, p.1438-47, 2010.

MARTINO, J. P. A review of selected recent advances in technological forecasting. *Technological Forecasting and Social Change*, n.70, p.719-733, 2003.

PORTER, A. L. Innovation forecasting using bibliometrics. *Competitive Intelligence Review*, v.9, n.4, p.11-19, 1998.

_____. Tech mining for future-oriented technology analyses. In: GLENN, J. C. & GORDON, T. J. (org.). *Futures Research Methodology*, 2009. Disponível em: *http://www.thevantagepoint.com/resources/articles/FRM%20chapter-TextMining-2009mar3.pdf*. Acesso em: 03/03/2010.

PORTER, A. L.; CUNNINGHAM, S. W. *Tech mining: exploiting new technologies for competitive advantage*. Hoboken, NJ: John Wiley & Sons, 2005.

PORTER, A. L.; DETAMPEL, M. J. Technology opportunities analysis. *Technological Forecasting and Social Change*, n.49, p.237-255, 1995.

PORTER, A. L. et al. Technology futures analysis: towards integration of the field and new methods. *Technological Forecasting and Social Change*, n.71, p.287-303, 2004.

PRICE, D. S. *Little science, big science*. New York: Columbia University Press, 1963.

SANTOS, M. M. ; COELHO, G. M.; SANTOS, D. M.; FELLOWS FILHO, L. Text mining as a valuable tool in foresight exercises: a study on nanotechnology. *Technological Forecasting and Social Change*, n.73, p.1013-1027, 2004.

SEARCH TECHNOLOGY. *VantagePoint user's guide*. Norcross, GA: Search Technology, 2009.

VANTI, N. A. P. Da bibliometria à webometria: uma exploração conceitual dos mecanismos utilizados para medir o registro da informação e a difusão do conhecimento. *Ciência da Informação*, Brasília, v. 31, n. 2, p. 152-162, maio/ago. 2002.

WEISS, S. M.; INDURKHYA, N.; ZHANG, T.; DAMERAU, F. J. *Text mining: predictive methods for analyzing unstructured information*. New York: Springer, 2005.

Aspects to consider when designing foresight processes

*Cristiano Hugo Cagnin**

Introduction

This paper describes both a communication approach and the key features of foresight in relation to policy design and implementation.

At JRC-IPTS foresight is considered to provide a framework for a group of people concerned with common issues in order to jointly debate, analyze and shape the future in a structured, creative and constructive way.

It is a participatory and inclusive process as it involves all relevant stakeholders, and an increasing number of citizens , into some form of dialogue or interaction in order to achieve a joint systemic understanding of the current situation and how it can evolve in the future.

In addition, foresight is an open process as it does not try to predict a predetermined future but rather to explore medium to long-term possible, probable and preferred alternative futures. It is a systemic and creative process put in place to allow participants to explore how the future might evolve depending on the actions of various actors and decisions taken today.

Foresight is therefore an action-oriented process aimed at shaping the future today, often through vision building processes intended for present day decisions and to mobilize joint actions.

* Directorate General Joint Research Centre Institute for Prospective and Technological Studies

Foresight is being increasingly geared towards the provision of support in tackling what is nowadays called 'grand societal challenges'[1] through innovation. Here are four pillars which are considered to be fundamental to foresight processes[2]:

- Information in order to understand complex interactions between products, services, users and other stakeholders in multiple contexts in which these products and services are used.
- Intelligence through scanning to explore trends, drivers of change, weak signals, surprises and wild cards, as well as persistent problems.
- Imagination in a holistic innovation ecosystem by integrating foresight, creativity and design.
- Interaction with the systematic involvement of users / stakeholders in early development stages in an inclusive process with long-term perspective and effective implementation.

Designing a foresight exercise

The first aspect to consider before starting any venture is to have a clear idea of what impact is intended within the system through analysis and how this shall be reflected in other interconnected systems (e.g. social, technological, economic, environmental, political, value, cultural, etc). Parallel to such an understanding is the need to ensure that all those who are responsible in making the necessary decisions for change are involved throughout the process at well defined stages and will therefore feel a sense of ownership of its results.

Foresight functions

To be able to identify what will be expected from a foresight exercise, it is important to know what foresight can deliver to policy making. Six functions have been identified[3]:

- Informing policy: generating insights regarding the dynamics of change, future challenges and options, along with new ideas, and transmitting them to policymakers as an input to policy conceptualisation and design.

---

1 Examples can range from demographic shifts, the provision of safe and adequate food supply for a growing population, the promotion of environmental sustainability practices able to preserve natural essential resources and revert resource depletion, the mitigation and adaption to climate change, the rise of new and return of previously eradicated diseases, the de-carbonisation of economies while securing energy supply, the preservation of democracy, the reduction of poverty, the fight against crime and terrorism, the management of the impacts of rapid technological change, etc.

2 Georghiou (2007); Saritas (2010).

3 Da Costa et al. (2008).

- Facilitating policy implementation: enhancing the capacity for change within a given policy field by building a common awareness of the current situation and future challenges, as well as new networks and visions among stakeholders.
- Embedding participation in policy making: facilitating the participation of civil society in the policy making process, thus improving its transparency and legitimacy.
- Supporting policy definition: jointly translating outcomes from the collective process into specific options for policy definition and implementation.
- Reconfiguring the policy system: in a way in which it becomes better prepared and apt to address long-term challenges.
- Symbolic function: indicating to the public that policy is based on rational information.

Foresight and policy impacts

As important as knowing what type of support foresight can deliver to policy making, it is equally as important to know at which stage(s) of the policy cycle one wants to have an impact. A foresight endeavour can assist policy making (Figure 1) in its first three stages: agenda-setting, policy definition and implementation.

In the agenda-setting stage, foresight can support by, for example, providing visions, understanding systemic and dynamic changes as well as risks, opportunities system capabilities, and stakeholders' views, among others. Similarly, at the stage of policy definition, foresight can provide ideas, recommendations and policy options, outlining related pros and cons as well as likely consequences to certain decisions.

At the first two stages of agenda-setting and policy definition, foresight can lead to the development of new networks or linkages, and the achievement of common ground, shared perspectives and joint visions.

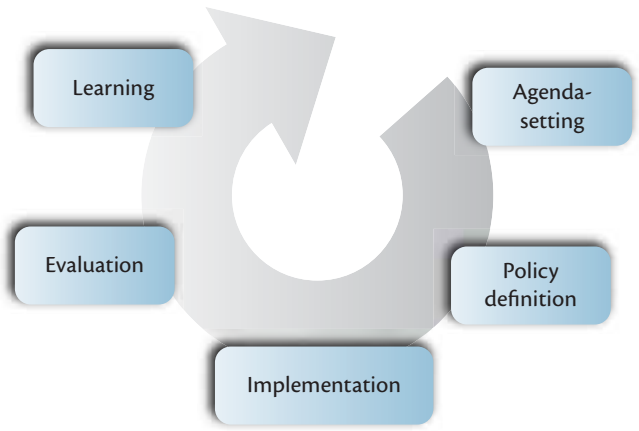


Figure 1. Policy Cycle

At the implementation phase, foresight can often assist with enhanced responsiveness to the system and new policy configurations, thus, leading to changes in attitudes towards the future such as embedding long-term thinking in decision making processes, raising overall awareness of challenges and opportunities, and the development of a foresight and learning culture.

Throughout the three above mentioned stages, foresight can benefit the system by also bringing legitimacy and transparency to the overall decision making process. Also, it is important to highlight that foresight is increasingly moving from providing support mainly from the agenda-setting phase to implementation.

Finally, it is critical to outline that this is not a linear model of policy making but rather a continual and reflexive process where foresight can be used as a systemic instrument complementing traditional steering approaches.

Communicating possible impacts to policy makers

In order to enable a better communication process between the policy client and those commissioned to carry out a foresight exercise or to enable policy makers to design the process themselves, a sketch (Figure. 2) has been developed and has been successfully used to kick off the discussion about what impacts should an exercise aim for.

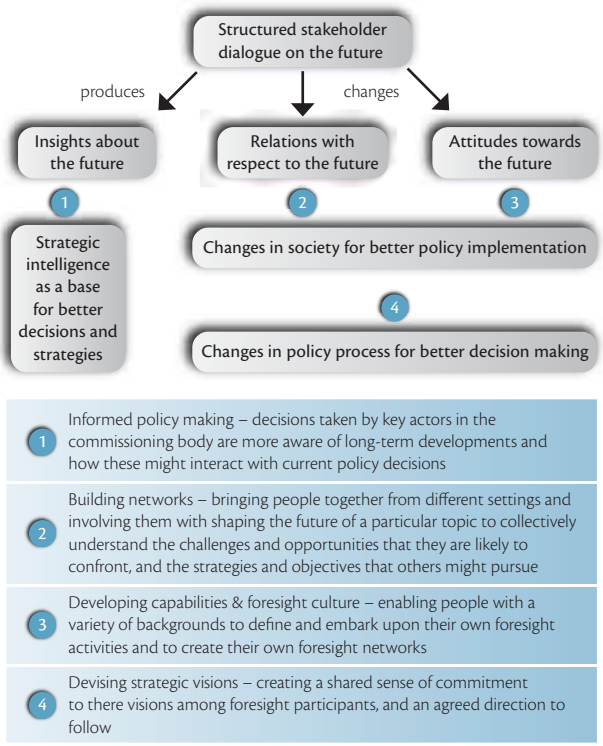


Figure 2. Foresight Impacts

Other design elements[4]

As already mentioned, a foresight exercise will be justified only by its subsequent impacts. Therefore, before committing substantial resources, it is necessary to find out whether the specific context will allow the exercise to be carried out satisfactorily and to have the desired impact on the system addressed. This is the essence of the feasibility phase. It should lead to a formal decision, taken jointly by the sponsors and the coordinator, to proceed, to refocus or even to halt the project. Political support may also be sought in these early phases, in order to raise awareness and bolster the credibility of the exercise.

Once the decision to proceed has been taken, a number of important decisions need to be made. These include issues such as: focus, objectives, users, outcomes, scope, approach, time horizon, and

4 FOR-LEARN (*http://forlearn.jrc.ec.europa.eu/*).

the expected duration of the exercise. The outcome of these decisions will normally be set out in a scoping document.

Finding and securing resources that are consonant with the focus, objectives and scope is one of the major challenges (if not the major challenge) during the design of the exercise. These resources will not only be financial (i.e. to cover the exercises costs), for which it will be necessary to find and convince sponsors, but also human resources (i.e. skills and competencies) and time (i.e. duration).

Before the exercise can be launched, a number of organisational structures need to be put in place or defined, such as a project team, a steering committee, and working groups of experts and stakeholders in each phase of the exercise. It will also be necessary to define a communication strategy, as communication is vital to the success of the exercise. The project team's first job will be to write the implementation plan defining the project in more detail.

The methodology, which acts as the skeleton of the exercise, is then to be designed according to the objectives and the desired outcomes of the exercise. It should be content and result-driven and should also take into account resource constraints. The methodology is evolutionary and will be redefined and refined through the process. It is subject to discussion with the sponsors, the team and stakeholders. In practical terms, it will translate into a set of methods to generate, elicit, structure, synthesise and capture the information needed at different stages of the process. Finding the appropriate sequence of methods is often one of the most delicate design steps. The methodological framework (i.e. the sequence of methods) needs to evolve and might be redefined and refined throughout the process depending on the selected approach to design decisions.

Managing a foresight project means applying the same rules of good project management as to any other project. Given the participatory nature of the process, there are two specific challenges to consider: continuous adaptation of the process and preserving the learning effect.

As in any project, managing time and people are key aspects. Although timeliness is critical, time can also be viewed as a cost, a constraint or a resource. In terms of managing people, there are different types of relationships that need to be handled in the foresight process. The foresight project team is the main body responsible for driving the relationships both inside the team and outside of it. Perhaps the most important are those with the client, the steering committee and the participants. Foresight is intrinsically participatory. Thus, a range of participants need to be involved, making participant enrollment a key task. There are three basic aspects to be considered at each stage of the process: roles/functions of the various participants, identifying participants, and engaging participants.

Also, for an exercise to be perceived as a success, and to ensure maximum benefit is derived from it, the exercise needs to be promoted to raise awareness and build broad support (both within policy circles and the general public). This can foster a sense of ownership and make it easier to implement the exercise's outcomes/recommendations.

Once the main tasks of the foresight exercise have been completed, a number of follow-up activities are required to ensure that the results are used effectively and all possible lessons are learned and passed on to future exercises. These may include: disseminating the results, evaluating the effectiveness of the exercise, and turning foresight into an ongoing activity. The evaluation of ongoing or completed foresight exercises, their processes, products, and outcomes, is essential to ensure accountability, credibility of the activity and to demonstrate to potential clients that foresight is a worthwhile investment. Foresight evaluation has to be designed carefully and various approaches are possible. Process evaluation is increasingly gaining as much importance as product evaluation since much of a foresight endeavour is about changing attitudes and behaviours towards a common goal.

Communicating design aspects to policy makers

With the view of ensuring better communication with the policy client or to enable policy makers to design the whole process themselves, a picture (Figure 3) has been developed and has been successfully used to shape more in-depth discussions when it comes to foresight design decisions.

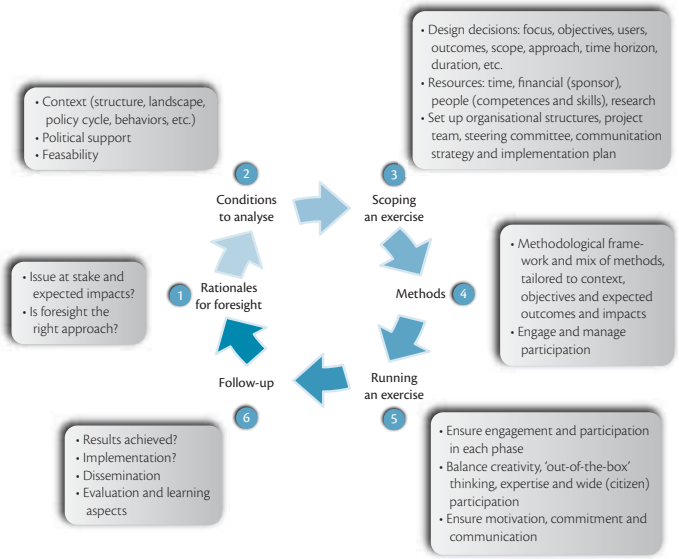


Figure 3. Key Foresight Aspects

Designing a foresight exercise in practice

Based on the experience gathered at JRC-IPTS in a number of Framework Programme (FP) projects[5], foresight trainings[6] and dedicated projects for EU Commission clients[7], it is often the case that an exercise needs to be shaped together with the client or project partners. Most of the time those involved in the discussions are not fully acquainted with foresight beyond the knowledge that it is a soft process for long-term decisions and without total control of those responsible in making decisions (as it is a bottom-up process that can be combined, but not necessarily, with top-down decisions).

It has been found that it is paramount to bring all participants in the discussion in order to have the same level of understanding before proceeding in shaping an exercise. As the term 'foresight' can be perceived differently by various stakeholders, JRC-IPTS in such discussions has been using instead the more generic term of 'structured stakeholder dialogue on the future'. In addition, after an initial debate on what impacts are intended at each stage of the policy cycle and before engaging into in-depth design discussions, JRC-IPTS has been using the stages of 'diagnosis', 'prognosis' and 'prescription' to start shaping an exercise (Figure 4). Within each of these three stages the discussion is geared towards identifying guiding questions (i.e. intended impacts and objectives), specific participants (i.e. type and level of stakeholders' participation), and specific combination of methods to structure the dialogue, all linked to the particular context in place.

The decision of intended impacts and objectives is linked to the actual possibility of acting upon results or implementing the required changes resulting from the process. In the same line, the decision on who participates and their level of involvement as well as methods used to structure the dialogue are dependent on issues such as the culture of decision making, political structures in place, etc. However, often exercises have been shaped in a way that at particular stages wide participation (aiming at including citizens in the debate) is sought for, especially in the beginning of the exercise (if not throughout the process) to collect diverse views on the issue as well as solutions to the challenge at hand.

5 FOR-LEARN, EFP, SESTI, FutMan, ManVis, EMUDE, UCIM, WBC-INCO.NET, ERA.NET_RUS, IMS, among others (*http://foresight.jrc.ec.europa.eu/projects.html*).

6 For policy and decision makers in EU New Member States, Candidate and Potential Candidate Countries as well as Newly Independent States (in collaboration with UNIDO).

7 Directorate General Research (DG RTD), Bureau of European Policy Advisers (BEPA) and European Institute of Innovation and Technology (EIT).

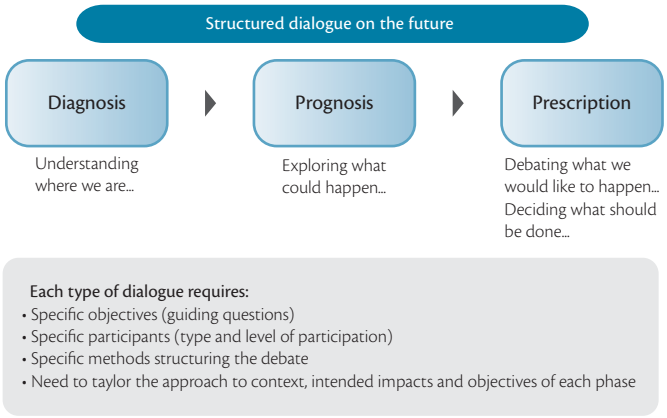


Figure 4. Basic Foresight Process

Example of the Western Balkan Countries (WBC) INCO.NET

The WBC-INCO.NET project started in 2008 to support cooperation between the EU, countries associated to FP7 and the WBC in Science and Technology (S&T). A number of activities have been taken in this regard, most notably the development of a methodology for S&T priority setting and the inclusion of stakeholders in the WBC and the EU in a political dialogue, including the EU Commission (EC), Parliament and Council, EU Member States and Associated Countries, as well as the Regional Cooperation Council.

The applied methodology combined quantitative and qualitative approaches and aimed at informing the EC about research topics relevant to the WBC with the idea of integrating these in the framework programmes (FPs). Three elements have been considered:

1) identification of topics of common interest for the WBC and the EU in the FPs,
2) their policy relevance to the WBC and the EU, especially for the enlargement process, and
3) identification of topics on special research niches in the WBC.

The methodology for S&T priority setting included quantitative elements focusing on the measurement of national S&T strengths and weaknesses. This was combined with a foresight process aimed at formulating promising or potential research themes for the region and corresponding resource allocations, which included vision building, networking for mobilising R&D communities and priority setting.

Five areas have been analysed using a pragmatic approach to the proposed methodology: 2) ICT (in cooperation with FP6 SCORE project), 2) AgroFood (in cooperation with FP6 BAFN project), 3) transport, 4) health, and 5) environment. For each a set between 3 and 5 thematic S&T recommendations has been produced. Results have been used both to inform national policy making and as input for funding programmes such as the SEE-ERA.NET PLUS project which coordinates unilateral, bilateral and multilateral RTD funding schemes between various EU member states and the WBC. A joint call for RTD proposals focusing on four of the priorities identified has already been launched.

Currently another field is being analysed following the same methodology: energy. Simultaneously, a bottom-up approach focusing on innovation is being shaped in order to combine the priority setting results achieved so far with research and capacity needs in the region to enable it to become fully integrated into the ERA by 2020. This shall combine foresight and joint programming to: 1) identify innovation and research needs by 2030, 2) assess identified needs outlining opportunities for collaboration in the region and beyond, 3) develop a 2030 vision for the region in terms of innovation, sustainability, integration into the ERA and openness to global partners, and 4) define a joint innovation action plan including RTDI priorities, adaptive policies, and instruments to be developed to attain the vision and identified milestones.

Figure 5 outlines the draft outcomes of the initial discussions on the way forward in designing the foresight process for a regional innovation agenda in the WBC.

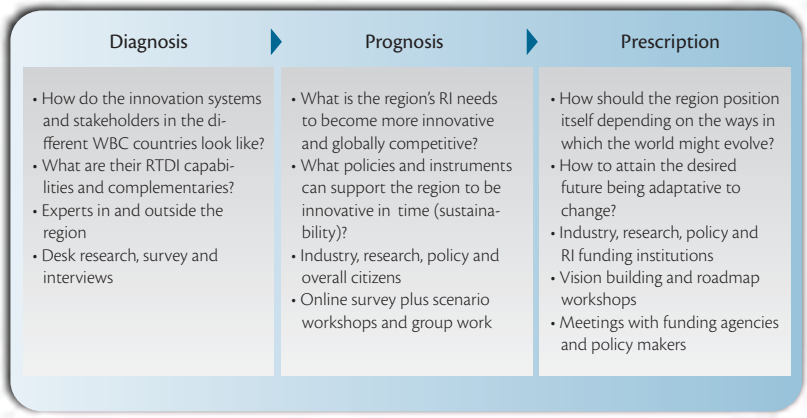


Figure 5. WBC-INCO.NET Innovation Action Plan

Currently the 'diagnosis' is occurring at the same time as the design of the online survey which will identify the RI needs of businesses in the region. The idea of the survey is to ask firms, S&T parks, business associations, etc to outline ideas for innovation that could contribute to an innovative region in the Western Balkans by the year 2030. In addition, participants will describe the characteristics of the innovation, its benefits, if there are any actions already in that direction, why this innovation would be best addressed through cooperation in the region, the research and skills needed to enable this innovation to thrive, and what policies should be in place to ensure this innovation will be fully mature by 2030.

In a second phase, the survey will ask both public and private research stakeholders to assess research themes / clusters identified in round 1 according to a set of criteria. Participants will have to spell out their willingness to work on identified research themes, both individually and collaboratively in the region outlining possible experts / institutions. They will also be asked about policies needed to enable collaboration to take place.

The final outcome from this stage will be priority research themes / clusters to be tackled through collaboration and policy needs along time to enable the region to be more innovative by 2030.

A series of scenarios, vision building and roadmap workshops will take place to support the definition of a joint innovation action plan for the region. The innovation agenda will be refined through discussions with funding institutions and policy makers in the region from aligning resources to identifying needs. To do so, good practices will be analyzed and assessed in terms of adaptability to the region and the findings will be used as input in such discussions. Also, networking, raising awareness and capacity building through a series of trainings for RTDI stakeholders will take place to enable stakeholders in the region to identify, select and manage the overall cycle of priorities to be fostered on time linked to policies, funding mechanisms and other instruments identified as important to strengthen the region's innovation capability through cooperation.

Example of the Intelligent Manufacturing System 2020

Intelligent Manufacturing System (IMS)[8] is an industry-led, international research and development (R&D) initiative established to develop the next generation of manufacturing and processing technologies. IMS2020 is a project funded by the NMP division of the European Commission

8 Companies and research institutions from the 27 member countries of the European Union, Japan, Korea, Switzerland, and the United States of America participate in this initiative. Other regions are encouraged to join.

within the IMS Framework, conducted by an international consortium from Europe, Japan, Korea, Switzerland and the USA.

In this context, the IMS2020 project strives to strengthen international cooperation under the IMS initiative. It will do so by providing an effective interface to ongoing European road mapping activities and by creating research synergies through the establishment of international manufacturing communities in five Key Areas or KATs.

- Sustainable manufacturing (KAT 1)
- Energy efficient manufacturing (KAT 2)
- Key technologies (KAT 3)
- Standardisation (KAT 4)
- Education (KAT 5)

The IMS2020 project is aimed at creating five research roadmaps towards Intelligent Manufacturing Systems by the year 2020 and beyond. Each roadmap is focused on one of the five above mentioned KATs.

Roadmaps[9] would ideally highlight the main milestones of innovation activities (R&D, management and policy actions) needed to achieve a desired vision. However, the project focused on the identification of relevant manufacturing research topics and supporting actions which are needed to shape the future of intelligent manufacturing through international cooperation.

The five mentioned roadmaps therefore outlined which research is needed to be performed through international collaboration to achieve a desired IMS2020 vision.

The project engaged participants from the whole IMS region and many other countries. JRC-IPTS elaborated a modular foresight architecture that allowed the engagement of numerous participants in different roles and different kinds of contributions. Much of the joint work was conducted using online tools including collaborative platforms like Wikipedia, online surveys and video/teleconferences combined with carefully prepared structured interviews and face-to-face meetings. The meetings were dedicated to the crucial phases such as the scenario formulation and the common definition of the vision for the road mapping work, which created a sufficient basis to continue refinement of the work in dedicated online spaces.

9 Phaal, R., Farrukh, C. & Probert, D. (2001); Phaal, R., Farrukh, C. & Probert, D. (2004); Phaal, R. & Probert, D. (2007); Könnölä, T. (2007); FOR-LEARN Online Foresight Guide (2009).

Both the devised vision and related roadmaps, which include the milestones of innovation activities identified, have been open for wide consultation in the IMS region and beyond through a wiki platform. Final results have been presented in the form of roadmaps between today and the end of FP8 to enable the EU Commission to identify and select research priorities to be funded collaboratively between today and 2020. Results are currently being used to shape further FP7 calls and to define FP8.

Figure 6 outlines the framework used in the initial discussions to shape decisions, Figure 7 shows the overall process undertaken in the project, while Figure 8 depicts the scenarios which have been selected to be developed in detail. Table 1 briefly outlines the IMS2020 vision showing all variables used in the construction of each scenario and the final vision, and finally Figure 9 gives an overview of how the results have been produced and are currently feeding Commission decisions.

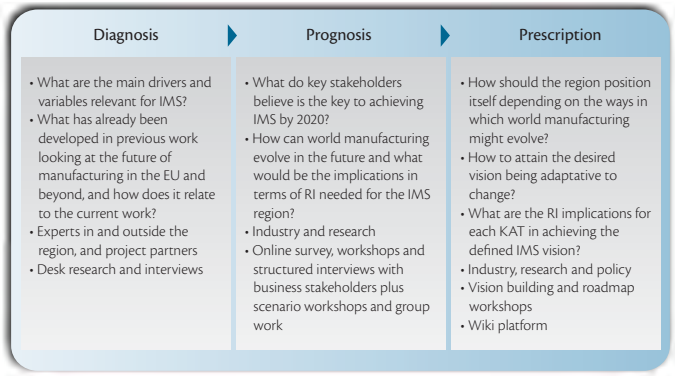


Figure 6. IMS2020 Initial Framework

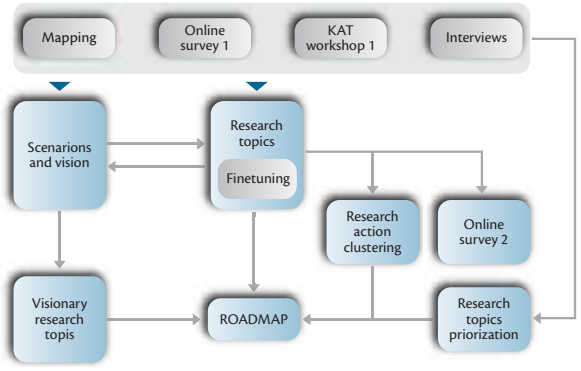


Figure 7. IMS2020 Overall Process

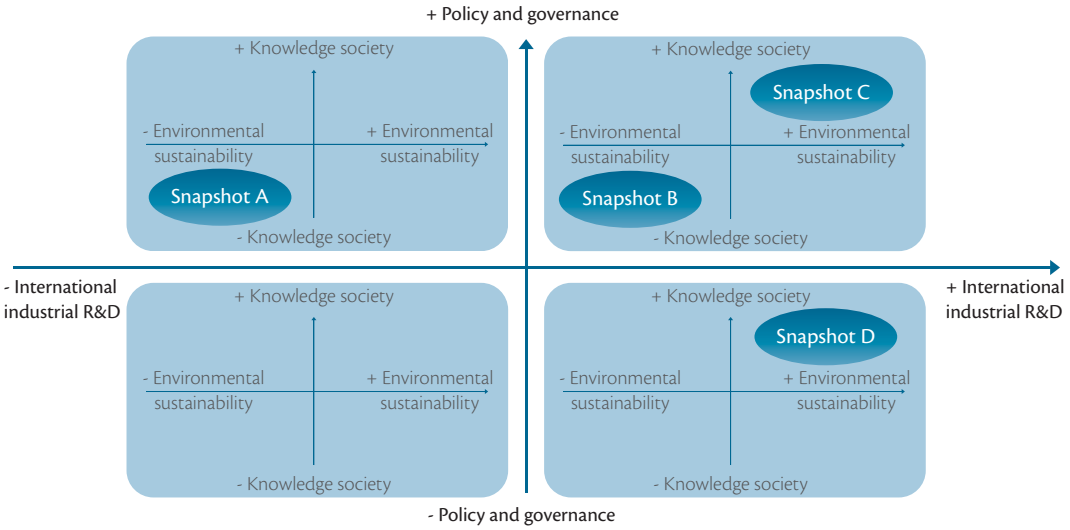


Figure 8. IMS2020 Scenarios

IMS 2020 Vision		
RTD Topics	Research Actions and expected impact	KAT vision and objectives
RT1.1 – RT1.8 – RT1.13 RT1.12 – RT1.6	RA 1-1 ... RA 1-n ...	KAT 1 objectives
RT2.1 – RT2.5 – RT2.3 RT2.2 – RT2.9 – RT2.7	RA 2-1 ... RA 2-n ...	KAT 2 objectives
RT3.3 – RT3.1 RT3.11 – RT3.10 RT3.2 – RT3.7 – RT3.6 – RT3.9	RA 3-1 ... RA 3-n ... RA 3-n ...	KAT 3 objectives

IMS2020 Scenarios

Table 1 - Final IMS2020 Vision[10]

Policies & regulations	Sustainability policies and related regulations, which comprise of an alignment between different policy realms, are globally aligned and enforced by supra-national institutions, which equally represent all world nations and support a shift towards participatory governance and decision making approaches.
Decision making	Multi-layer bottom-up and long term decision making processes are established both by governments and industries, both with each other and with overall societies. This is the backbone of greater inclusion, reduction of development gap between rich and poor nations, and sustainable manufacturing.
Collaboration	Collaboration between governments, industries and societies, enabled by IT (Web 2.0) and accessible education to all, which allows for raising citizens awareness and engaging in decision making processes and co-designing of a global regulatory framework that is enforced by supra-national institutions.
Partnerships	Partnerships and a balance between cooperation and competition are the soft rules for all relationships, allowing value chain networks to self-organise and thus firms to effectively and transparently cooperate and trust partners, while maintaining competitive advantages related to core competences.
Values & behaviours	Shift in societies' values and behaviours from current individual consumers towards collective and sustainability values, with life and relationships being valued more than the single need, which is only met when in alignment with global values such as human rights.
Life cycle & performance	Solutions (products + services + processes) designed and managed throughout their life cycles based on the 'eternal' life cycle approach, which means that they do not generate waste and that every material or resource is continuously transformed, and is geared by renewable and alternative energy sources.
Technology	Value chains are driven by sustainability and new technologies such as nuclear fusion, hydrogen, new production technologies, etc., all of which allow for information sharing and tractability, reuse / recycle through assembly and disassembly, and sustainable end of life (i.e. biodegradable or edible materials).
Localisation	Solutions are not only globally localised (i.e. communities) but customised to individuals. These are co-created with end users, who participate in the process from the identification of specific needs towards the design, production, delivery and disposal (reuse or recycle) of solutions and materials used.
Markets	Global markets are regulated through common rules enforced by supra-national organisations. Firms organised through global value chains which are highly flexible and able to self-organise. Value chain networks are created as partnerships which are built according to specific needs, solutions and actors.

10 Cagnin (2009).

Standardisation & regulation	Regulations are globally co-designed and enforced by supra-national organisations. Standards shift towards sustainable solutions and processes of user engagement, which include technologies which speed the process of identifying a particular need and the further rapid manufacturing of solutions.
Knowledge	Knowledge is jointly generated, automatically distributed and exploited in cooperation. It is part of a collective intelligent network (i.e. global brain) with different IPR systems, which allow tacit knowledge to become collective and explicit.
Education	Education is pervasive to all human activities; it takes place at any time and anywhere. It is provided by a multitude of actors, in alignment with institutions and in collaboration with industry and governments.
Curricula	Curricula is personalised since individuals learn through experience, which means that they actively participate in the learning process.
Competence and skills	New skills and competences are deployed providing individuals and institutions with the necessary capabilities to anticipate and adapt to change and think long term (i.e. foresight).
Learning	Learning takes place at any time and anywhere and is geared towards individual experience rather than traditional learning methods.
Energy	Smart grids for energy co-generation at the point of consumption, and distribution involving all stakeholders (i.e. industry, governments and citizens at home and in the office), which allow for energy efficiency close to 100%. Alternative and renewable sources of energy drive manufacturing.
Natural resources & materials	Natural resources are used in an intelligent way with zero waste and zero losses, allowing for conservation and renewability (in case of renewable resources). Ownership of resources and sustainability internationally recognised and globally ensured, supporting changes in geopolitics.
Environmental footprint	Environmental footprint is positive. New geopolitics support reduction in development gap between rich and poor. All countries have equal access to wealth and education as well as responsibility towards the collective. Business value becomes a balance of economic, social, environmental, spatial, cultural and political capital, which is enabled through stakeholder engagement (co-creation and open innovation).

References

CAGNIN, C. *Scenarios snapshots and IMS2020 Vision*. Deliverable D2.2. of IMS2020 Project Number 233469. 2009.

DA COSTA, O.; WARNKE, P.; CAGNIN, C.; SCAPOLO, F. Foresight's impact on policy-making: insights from the FORLEARN mutual learning process. *Technology Analysis and Strategic Management*, v. 20, n. 3. 2008.

FOR-LEARN Online Foresight Guide. 2009. Disponível em: *http://forlearn.jrc.ec.europa.eu/guide/0_home/index.htm*

GEORGHIOU, L. Future of foresighting for economic development. In: Unido Technology Foresight Summit on Water Productivity in Industry. Budapest, 27-29/09/2007. *Trabalho apresentado...* 2007.

KÖNNÖLÄ, T. Innovation roadmap: exploring alternative futures of industrial renewal. Conference on corporate R&D (CONCORD): new and emerging issues in corporate R&D, JRC-IPTS, 8-9/10/2007. *Trabalho apresentado...* 2007.

PHAAL, R., FARRUKH, C. & PROBERT, D. *Technology roadmapping: linking technology resources to business objectives.* University of Cambridge, 14/11/2001. 2001.

PHAAL, R., FARRUKH, C. & PROBERT, D. Technology roadmapping – a planning framework for evolution and revolution. *Technological forecasting and social change*, 71; 5-26. 2004.

PHAAL, R. & PROBERT, D. *Technology roadmapping: facilitating collaborative research strategy.* University of Cambridge, 14/05/2007. 2007.

SARITAS, O. Presentation at the innovation dialogue forum: towards a western Balkan region innovation system. Becici, Montenegro, 8-9 November, 2010. *Trabalho apresentado...* 2010.

New windows onto new worlds: the case for integral foresight

Richard David Hames *

Hypothesis

Set against the rich tapestry of mankind's evolution on this planet our current era seems increasingly to be characterised by escalating turmoil and disquiet on so many different fronts. The scent of suffering and uncertainty hangs eerily in the air.

A feeling that our lives are spitnning out of control is made all the more palpable by three overwhelming factors:

1) Excessive affluence in the post-industrial world compared to the crushing poverty, inequality and injustice experienced by citizens elsewhere.
2) Western petulance and hubris that allows empires in decline (together with the institutions responsible for initiating and perpetuating this madness) to believe it is their exclusive right to resolve all its problems – even if they had the capacity to do so, which they do not.
3) Our willingness to give up serious intellectual debate in return for a media intent on diverting collective attention via a squalid mix of sanitized news, entertaining pap and a seemingly endless parade of celebrities behaving badly.

Progress itself has become a dangerous delusion. One has only to reflect on the news headlines that bombard us throughout our waking hours: an unremitting nightmare of horror, corruption, ecological catastrophe and the spiralling costs of even the most basic elements required to sustain life – cheap food, potable water and plentiful energy. In all of this turmoil our humanity has gone missing. Purer intentions have been lost. We are in thrall to materialism; obsessed by economic and political power in ways that could easily wreck our way of life – if the past collapse of previous civilizations is any judge.

* President, Asian Foresight Institute, Thailand.

The future is indeed grim if we remain adrift in circumstances that threaten to undo everything beneficial and abundant and beautiful we have struggled to create.

Unknowingly perhaps, but frighteningly real nevertheless, our actions have spawned almost perfect conditions for the mass extinction of Homo sapiens. The truly terrifying thought is that we have developed an awareness to know this is the case as well as the intelligence to do something about it. But is it too late for wisdom to prevail?

Over the coming decades we will need to undertake something we have never done before. We will need to redesign the material basis of our civilization. There is no precedent for this. No process flow chart. No rule book. No training manual. No compass directing us towards more desirable futures. Nor is there much leadership evident as yet. Politicians, bureaucrats and business tycoons appear traumatised by the extent, scale and complexity of the problems facing society. Like rabbits caught in the headlights, their inclination is to wait and to wonder. Astonished by global forces they happily unleashed, particularly their systemic nature and fickle twists and turns, leaders seem paralysed within the here and now of "business as usual". Except now there can be no business as usual.

As a consequence their reactions are typically confined to an evasion of long-term issues, a denial of the limits imposed by physics and an assumption that we are all witness to the same truths and aspire to similar goals. Denying realities that resist conventional analysis they choose instead to quibble about today's trivia in a concern to protect national interests, dithering and chattering about matters that are ultimately of negligible consequence.

But wait. Perhaps we have been looking in the wrong places for viable solutions. Despair, after all, does not loom large in humanity's chronicles. The human spirit is far too resilient and adventurous for that. Optimism and hope can spread its wings once again.

Already a new consciousness is evident in certain quarters, particularly among the young who are not weighed down by the gravitational pull of the past and also in parts of the world relatively unsullied by the crushing dominance of the prevailing materialism of the civilizational worldview. This is especially apparent in parts of Asia and across the "global south" of the developing world.

In pockets around the world a cadre of enlightened, purposeful and interconnected individuals is emerging. Many of these people live in places where their voices have been hard to hear above the din of imperially mandated bluster. Their ideas, often transcending discrete cultures, ideologies and history, have been routinely excluded from mainstream debate because of poverty, geography,

ostracism and oppression. Which is insane. Their unique experiences can help us comprehend what needs to be done and we need to listen loudly to propositions that offer genuine alternatives to the overbearing Western paradigm that locks us in a trap of escalating production and excessive consumption.

To unlock that trap will not be easy. The way forward is not contained within conventional approaches, competitive states or bullying nations – even less in trying to dominate nature or ignore humanity's impact on the biosphere. On the contrary it is embodied within integral intelligence, collaborative networks, appreciative systems and, above all I believe, the liberation of wisdom through *integral foresight*.

But in order for these new voices to be heard, their ideas incorporated into global dialogue and their advice acted upon, we all need to think differently. Innovation has to embed at the level of human purpose, strategic philosophy and societal institutions. Only then might we create a context that allows us to *see* differently. And *seeing* differently is necessary if we are to *behave* differently.

Futuring (the practice of strategic foresight) has rarely been utilised as an enabler of intentional evolutionary design. Most of the time it has lapsed into abridged models and tools that remain both disconnected from pragmatic political, commercial and social realities on the one hand, while burdened by a lack of imagination on the other.

It is no accident that the overwhelming narrative in today's society is one of futile blandness. Foresight as most commonly practiced (with its emphasis on coherent trends and its appropriation by pop science, engineering and technology) oscillates between tedious logic at one extreme and corporate clairvoyance at the other. In truth foresight as practiced often constrains our thinking although its advocates would have us believe the opposite. Too many futuring projects remain a prisoner of convention and stale orthodoxies. Why? Because foresight has become just another instructional toolkit. It is no longer transformative, either in form or content.

The great French 20th century philosopher Henri Bergson asserted that the tools of the mind become a burden on our development when the environment that once made them so necessary no longer exists or has morphed into something quite different. I believe we have unwittingly allowed the practice of foresight to fall into that trap.

It follows that the future praxis of strategic foresight offers us a rare opportunity to create unique value through demolishing orthodoxies that are well past their shelf life while liberating new wisdom. Whatever form that might take, and whatever tools are used for that purpose, we must remain

mindful that the ultimate goal is (a) to design an engaging method for imagining viable pathways that (b) shed light on how we can make provision for the future needs of humanity (c) in ways that lead to more intelligent, resilient choices and through the demonstration of more coherent, empathetic collaboration than has previously been possible.

Integral foresight[1] (a deeply systemic framework for comprehending and reacting to panarchic[2] relationships at a paradigmatic level in which intuition and reason are interwoven across individual and collective levels of human experience) offers us one such pathway – but only as long as we remain open to the implicit systemic and existential challenges this framework introduces.

The most challenging of these is the need to transcend the *civilizational worldview* to which most of humanity unconsciously subscribes in one way or another.

The civilizational worldview

The *civilizational* worldview is as natural to us as the air we breathe. We are not conscious of any competing framework. We respond autonomically to its principles, an implicit framework and guide to all that we value and assume to be a normal part of being human. In effect it is the life-condition we discern, experience each day of our life, and in which we are immersed from birth.

This worldview has endured at least since feudal times and possibly much longer. Along the way it has been reified by sundry beliefs related to human purpose and capability, tested by competing ideologies and sustained by five moral impulses.[3]

These theories, ideologies and impulses have been progressively moulded into a set of seven deeply ingrained tenets defining what the majority of humanity believes to be *real* – and consequently incontrovertible in terms of the human condition:

1 Integral foresight in our context is the all-encompassing domain of human consciousness, experience and knowledge. It includes the various theories put forward by contemporary scholars like Ken Wilber, Rudolf Steiner, Sri Aurobindo and Ervin Laszlo as well as those in other, more ancient traditions.

2 Panarchy is the framework in which systems, including those of nature (such as forests and oceans) and of humans (such as capitalism and governance) as well as combined human-natural systems (such as institutions that govern the use of natural resources) are interlinked in continual adaptive cycles of growth, accumulation, restructuring, and renewal.

3 These five foundational moral impulses are best depicted as (i) it is wrong to hurt people (ii) justice and fairness are good qualities (iii) allegiance, loyalty and patriotism are virtues (iv) people should respect social hierarchy (v) purity and sanctity are good while contamination and pollution (and their associated character traits of greed and lust) are bad. Note that different cultures and groups bring different weightings to these shared five moral imperatives.

1) A ruling power elite serviced by a cooperative and subservient underclass of slaves or surfs
2) Wealth and power acquired by the elite at the surfs' expense and protected via state political, military or policing mechanisms
3) An all-encompassing religious or superstitious structure (where the elite are commonly depicted as representatives of a deity or divine beings) typically used to manufacture consent
4) An industrial war machine viewed as a crucial, often principal, driver of the economy and in which all aspects of production are controlled by the elite through such things as language, access and skills acquisition
5) Sport, entertainment, education and media are used as a social distraction in ways that help maintain compliance within the social order
6) Nature and the environment are exploited as a "god given" right
7) An irresistible narrative within society based upon competition, indifference and scarcity – rather than cooperation, empathy and abundance.

Of course this set of seven attributes does not imply a universally applicable mono-cultural integrity. On the contrary our worldview is a chameleon, changing its tone, color and intensity according to its surroundings or, in a social context, its culture. But the critical thing to appreciate is that this worldview was invented by humanity. It is a social construction and, as such, can be remodeled – if that is what we want.

A more profound dimension of the worldview that we must take into account is the variances that occur within and between different cultural mindsets. The fact that we do not take these mindsets into account most of the time is one of the most glaring reasons for transcultural misinterpretation and international follies.

Of course taking cultural mindsets and their associated value systems into account can complicate matters considerably. Let me explain. There are three dominant mindsets in our current world-system: these are the Occidental, the Sinic and the Indic mindsets. Each aspires to perfection and sees *truth* and *beauty* in different ways. The Occidental mindset, for example, perceives reality as a rationally explicable system of physical artifacts, calibrations and observations. The Indic mindset sets far greater store from internal reflection and spiritual transcendence. The Sinic mindset, on the other hand, values balance in all things; this is the yin and yang preserving a delicate equilibrium between two poles.

There are other secondary mindsets that were once considerably more important in locally circumscribed situations than they are today in a global context. The ancient Amerindian, African Ubuntu and Indigenous mindsets, for example, hold far less sway in today's world, largely because they signify concerns, values, relationships and ideals that do not sit comfortably with our addiction to material wealth. Perhaps, for that very reason, we should pay more attention to them, especially in terms of how we develop a greater consciousness of evolving to a less exploitative worldview where communities can live in harmony with each other and nature.

Finally, to make things even more complicated, there are subtle hybrids that blur the distinctions between multiple mindsets – as in the recent amalgam of the dominant contemporary mindsets across much of Asia, resulting in part from globalization as well as the intended and unintended consequences of imperialism.

Thus a multitude of different interpretations and understandings can materialize from societies operating from within differing cultural mindsets – to the extent that extreme behavioural divergence between them is often evident even though the worldview itself, we must remember, is a shared phenomenon.

So, depending upon our cultural upbringing and mode of induction into the modern world-system, we will invariably see and respond to the civilizational worldview through a distorting lens and with an intensity that differs from one society to the next and reflects deeply implanted cultural attributes.

Because of this we also have a tendency to apply differently nuanced operating models (including the language used to express priorities and principles) to policy, governance, organizational and management issues that may give the impression of contradictory interests and needs. This impression is part illusion and part fact. A reality check can be undertaken by comparing such apparently conflicting interests with how the five moral impulses play out in each case. These checks invariably surface basic needs and expectations that are universally applicable to the entire human family – irrespective of other incidental and local factors.

It is only comparatively recently that there has been any rigorous critical appraisal of the civilizational worldview – something almost unattainable from within. But there are now sufficient numbers of highly complex, interconnected, escalating, seemingly irresolvable problems created or nourished by this worldview, that are leading many thoughtful individuals to question how much longer the entropic nature of the civilizational worldview can persist before totally unraveling into chaos.

This is not whimsy but a grave existential question and one suited to exploration through integral foresight. Given the diverse crises facing humanity, and particularly the gathering perfect storm of intersecting economic, energy and environmental issues, we are reluctantly coming to terms with the proposition that there are indeed fixed limits to growth and development. Furthermore we are hitting that wall now. The futility of pretending we are above such physical limitations is enshrined in our powerlessness to challenge those immutable laws of nature we have previously chosen to disregard.

Ignoring these natural laws is no longer an option. The human condition cries out for an alternative paradigm, one crafted to be intentionally viable and resilient and based upon design criteria that will make provision for the needs of humanity as a whole rather than pandering to a wealthy minority. The case for a new design, together with the process of letting go of stuff we still take for granted, becomes apparent when we look at just one of the many crises facing us. Consider this….

The environmental crisis

> *Eleven of the past fourteen years have been the hottest on record. The Nepalese leadership recently held a cabinet meeting on Mount Everest in order to draw attention to rising temperatures that have dramatically reduced snowfall over the roof of the world. The government of the Maldives held a cabinet meeting underwater to highlight the threat of global warming to the low-lying Indian Ocean nation. In Bolivia, glaciers that hold the nation's water supplies are rapidly dwindling. The Arctic is melting so fast the ice cap is likely to have disappeared by the end of the century. Even East Antarctica, long stable, is now losing ice.*
>
> *Elsewhere drought, floods, earthquakes and fires wreak havoc. Deforested peat lands in Indonesia are drying out and burning and the future of the Amazonian rainforest is similarly endangered. In parts of Australia drought and flood, once cyclical, are now considered a permanent condition. Rivers everywhere, including the mighty Ganges, an inextricable part of India's physical and cultural landscape, are drying up, leaving only desiccated earth and dust bowls.*
>
> *The marshlands between the rivers Tigris and Euphrates, fabled site of the Garden of Eden, a land so rich in soil and water that it would quench the needs of its dwellers throughout eternity, emits the unmistakably pungent stench of a dying ecosystem.*

Meanwhile the massive floods that killed hundreds of people in the Philippines this past summer are becoming the norm. Nor are such extreme weather events confined to the tropics or the polar regions. Agriculture in the United States was ravaged in 2010 by droughts in Texas and California, heat waves in Louisiana and Nebraska, floods in Minnesota and torrential rains in Illinois.

In Venice, a major trade hub and maritime power in the Middle Ages and still one of the most idyllic cities in the world, the number of permanent residents is hovering at around 60,000, having halved during the past fifty years. Why? Because Venice is sinking into its own foundations. Bangkok too, once romantically referred to as the Venice of the East and my home for the past six years, is sinking into coastal mud at an alarming rate of up to three centimeters each year.

Marine life, too, is being killed indiscriminately. Only 10 per cent of all large fish (both open ocean species including tuna, swordfish, marlin and large ground fish such as cod, halibut, skate and flounder) remain in the sea. Toxins and pollutants combined with current rates of ocean acidification could potentially deprive future generations of all wild seafood. We are now causing species to become extinct faster than they are being replaced.

On every continent desperate nomads are migrating further and further from traditional homelands, many of them inhabiting the vast urban metropolises which are now home to over 50 per cent of the world's population. As many as 200 million people are destined to become climate migrants by 2050, destabilizing the global economy in a process that will inevitably result in escalating poverty, inequality and conflict.

Scepticism, excuses and rationalizations for delay are accompanied by assertions from many quarters that there are more pressing problems to be addressed, such as terrorism, the spiraling cost of food, the scarcity of potable water, genocide, disease, famine and injustice. What is not often understood, and even less frequently stated publicly, is that all these symptoms of a society and a planet in a state of distress are merely the predictable consequences of how we have deliberately designed things. They are a result of the civilizational worldview working as it was intended.

As far as I can tell these statements are no exaggeration but, on the contrary, a fairly conservative assessment of our current predicament – cynics not withstanding. They are not lies but validated evidence that climate change is real. However they do not offer viable future pathways or posit resilient design. Indeed they stop at that critical juncture between *sensing* what is going on and *design* – i.e. bringing fresh insights into strategic focus and action.

Of more concern is the content and tone of messages that play into the dominant media meme[4] is-à-vis climate change, one that is increasingly projected onto such subject matter through alarmist, at times almost hysterical, articles, opinion pieces, websites, television news, cinematic fiction, summits and conferences. Containing a range of disquieting facts, statistics and dumbed-down opinion, the "green meme" of impending human catastrophe has become the dominant global narrative within the context of our relationship to the environment and, not surprisingly, it is generating anxiety and paralysis within communities. Indeed it is a first-rate example of what happens when awareness of a situation is enhanced without any thought being given to the consequences of such raised awareness in the collective psyche.

As it happens this meme underpins many of the scenarios saturating our waking hours, choking confidence and playing to our fears, doubts and superstitions in ways that abandon any sense of a better future. Scenarios depicting positive outcomes are scorned or considered irresponsible by the merchants of doom and gloom. In this psychotic state almost everything about the past (including, of course, the socio-economic platform that gave rise to affluence and to modern lifestyles) takes on a romantic perspective, while almost everything about the future is couched in depressing terms. Regrettably our nostalgia for the past is a seductive lie, it merely engenders apathy: instead of aspiring to fresh goals we do everything in our power not to lose that which we had. Energy dissipates right there!

As a consequence zero-sum games remain the actuality. Entangled in a transition we never intended and never thought possible, one that threatens to depose some of our most fundamental tenets and over which we have seemingly less control by the day, we are traumatized by an ominous sense of foreboding and the ennui of uncertainty.

Instead of embracing an energizing potential for renewal, especially the possibility of attending to inequities generated by increasingly predatory forms of capitalism, we descend prematurely into melancholy, grieving for the sacrifices to come and striving to avoid the pain of disassociation.

---

4 An idea originally proposed by Richard Dawkins, author of The Selfish Gene, a meme acts as a vehicle for conveying cultural ideas, symbols or practices, which can be transmitted from one mind to another through writing, speech, gestures, rituals or other imitable phenomena. Memes can be regarded as cultural analogues to genes in that they self-replicate mutate and respond to selective pressures.

In most cases that just means carrying on with life – turning a blind eye to worsening forecasts and devastating events, doing what we can to protect our own parochial interests, and all the while putting our trust in promises of further economic expansion and growth when that is clearly the root cause of our current mess. How absurd!

In these circumstance is it really any wonder vast numbers of citizens just switch off, get angry, or try to deny the limits inherent in nature that stare us in the face? Why should it surprise us when individuals search for ways to evade discomfort and to conserve, or even improve, their present life-style? Should we continue to belittle and censure those who simply hanker for the conspiracy theorists to be correct and the scientists wrong? Is it not human nature that we should turn our backs on a future seemingly devoid of any optimism or joy?

Intentional evolution

There are far more inspiring alternatives to the enervating cynicism, uncertainties and increasingly shrill revelations of impending disaster that flood our daily lives. Stories that offer hope and intentions that chronicle a brighter future for all. Human civilization is certainly in a state of transition. Indeed I believe we have reached a developmental crisis point – one that necessitates a redefinition of what we interpret to be *progress*.

Yet while we can only analyze past transitions, the future paradigm still remains ours to invent. Along with technological revolutions, socio-economic crises offer exceptional opportunities to move to higher levels of evolution. We just need to be able to see the promise of societal renewal with greater clarity and conviction, which is why *context* (the framework within which we make meaning) becomes so vital.

Contextual conditions both establish and reflect dominant belief systems in the culture. An appreciation of context becomes particularly critical when so many of the ideas and institutions defining our culture appear to be breaking down. This is the case today and it is the ideal time to be learning from other cultural mindsets as an alternative to insisting upon the validity of the Occidental position.

Possibly the most profound transition in history, one that has taken literally hundreds of years so far and is still far from completion, was the move away from pious notions of an infallible 'maker' or supreme being, to the concept of scientific materialism. Here it is the physical world that really matters. This shift required discarding deeply imprinted fears and fallacies. Unsurprisingly it led to

the modern obsession with material goods and the acquisition of personal wealth. But evolution cannot stop there.

We must now move beyond even that phase of understanding. Among the most vital of contemporary principles is the rejection of the idea of the world as a physical machine. The transition towards a new society instilled with such a fundamental ontological shift appears most likely to lead to a new holistic consciousness that integrates both science and spirit. Yet the practical realities of governing a global population of seven billion people still lag far behind conceptions.

In the past at least part of the problem was our inability or unwillingness to engage with really big issues (such as environmental degradation or the alienation of young people) in any meaningful or constructive manner. Our inclination to delegate important decisions to others for example (whether to dictators, monarchs, professional managers or councils of elected representatives) was deemed pragmatic. In reality it represented a disquieting social apathy – a deeply ingrained passivity that is extremely difficult to overcome. What is more it often allowed corruption, misconduct and oppression to thrive, to which we then turned a blind eye for fear of attracting still further repression. Many communities still suffer from that indifference today.

With the advent of today's sophisticated communications systems and online social media, however, there can be no excuse. People are able to speak out and air their concerns, wielding power in ways that were previously out of the question. Governments and dictators fall at the hands of people power. Today, the voice of every citizen can be heard. Individuals can contribute to a global community of mind (a collective intelligence for change) should they wish to do so. Indeed some commentators argue the case that it is increasingly impossible to remain quarantined from such participation, given the potency and insidious nature of new social media. Furthermore, new social networks help create the *collective consciousness* we so urgently need to reboot ciivilization.

In attempting to address the inevitable impacts of our crowded hot planet on individual lifestyles the application of such crowd-sourced intelligence, supported by all the innate wisdom and expertise we can muster, is vital. But whereas collective intelligence urges the immediate deployment of smart technologies, a shift to clean energy and the rapid phasing out of toxic products and practices, wisdom entreats us to pause, to change the conversation, to pose questions that are currently not part of the dialogue.

As far as I am concerned some of the more important questions we should be pondering are not even on the agenda. While the greatest threats to humanity and to our environment seem to be

that nothing is done, that the wrong things are done too quickly, or that too little is done too late, the greatest threat to our social well being is that we act without wisdom.

The most urgent questions for humanity no longer focus on discrete issues and their impact but on how we can adapt and evolve to changing conditions, lessening the damage wherever we can and exploiting opportunities that are bound to emerge and delaying more serious consequences. There are two philosophical questions we need to answer: how can we tread more lightly on this planet and how can we preserve for future generations what is uniquely beautiful and inherently precious about our world?

A critical role

So far our response to these questions has been depressingly inadequate. On deeper, more spiritual issues, such as how we can accelerate our capacity to adapt to the laws of physics in ways that enable more sustainable relationships, with each other and with the Earth, there has been a deafening silence.

Within this context the role of foresight is critical. But the methodology itself will need to evolve and adapt as an integral praxis in the following ways:

1) Practitioners must ensure that foresight offers the possibility for identifying the true nature of individual and collective pathologies as well as putting forward solutions that are systemically viable and strategically resilient in a context that is morphing by the minute. The former demands real-time strategic intelligence, uncompromised by filtering and compartmentalized thinking, while the latter requires a genuine mix of systemic consciousness and imagination coupled with commercial pragmatism and entrepreneurial flair.
2) Foresight must shift from its obsession with technology and uncomplicated issues to encompass a broader mix of 'higher altitude' observations about the purpose of humanity, the provisioning of resources to accommodate the needs of an escalating global population, design criteria for social change, disparities between affluent and less privileged individuals and communities, and the rules and conventions that exacerbate division, competition and conflict within society.
3) Tools and methods must embrace both crowdsourced insights and expert opinion in an attempt to transcend obsolete knowledge and epistemologies in the co-design of new wisdom. This will take an expansive process of collaborative inquiry blended with a curated dialogue that probes far more deeply into our inner belief systems and collective cultural traits than has hitherto been considered relevant.

4) Foresight must move from conventional environments into immersive decision theatres that (1) facilitate the visualization of dynamically complex patterns, (2) where the mapping of intended and unintended consequences of decisions can be undertaken more rigorously and comprehensively, and (3) where solutions can be prototyped and stress-tested. In a similar vein, scenarists must develop the capability for stewarding strategic conversations in real time. They will need to have the full range of relevant models and theories-in-play at their disposal in order to guide, provoke and compose a seamless dialogue that includes and transcends old knowledge.

5) Whole-system, collaborative inquiry and design conversations must take pre-eminence over other misused and increasingly hackneyed foresight methods. This is critical if we are to really engage a broader clientele in understanding that emergent patterns in our systems are simply the product of the way the system has been designed to function. Re-framing symptoms (as we often do during the crafting of scenarios) is a distraction; inadvertently shifting attention away from fundamental causes. Re-design the system, however (or, more accurately, the intentions informing that design) and we solve the actual issues and dilemmas we are trying to grapple with – in addition, quite possibly, to resolving many other related concerns.

   It is also worth noting that when we are preoccupied with discrete technical issues and observable trends (as typically happens, for example, when scenario methods and technology roadmaps are adopted) our tendency is to converge around explicit goals we want to achieve or explicit futures we want to avoid.[5] This is a mind-trap. Being overly attached to a particular outcome, especially one linked to a so-called *focusing* question, can deceive us into believing that the goal itself is of greater import than the desired end-state. As evidenced by the fact there is so much insipid and uninspired strategic thinking in corporate life today, this attachment can drag us further away from any deeper intentions we might long to embed in the system.

6) Foresight can no longer simply be about the future. It must pull information from past and future states into an *expanded now* of new consciousness. In this way the field of strategic foresight itself can be expanded, becoming genuinely transformative and therefore more strategically significant.

Future pathways

There is no doubt traditional foresight methods have been remarkably useful in the development of a more sophisticated approach to strategic thinking – especially in allowing us to imagine and

5 I am using the term "outcome" as applying to a number of resulting changes we wish to experience within a system rather than that experience in its totality which I prefer to define as a "desired state".

rehearse what we would do if future realities turn out not to match our best-informed guesses. Today these same foresight methods require philosophical and operational upgrades if they are to remain relevant.

Without valid strategic foresight we put in jeopardy both the highly sophisticated nature of our society as well as its more pragmatic capacity to produce and distribute life's necessities. One might perceive this threat as a potential collision between fate and desire. In that context, risks appear to have emerged as a direct result of the way we think – about our needs, our rights, our aspirations and our interactions, particularly relative to each other and to the planet.

Now we must think again. And differently this time. Not only through different lenses but also from a variety of altitudes. Integral foresight methods can help us move beyond the civilizational worldview by:

- Reimagining our collective purpose – particularly ensuring that prosperity, well-being, equity and justice are rights to be inherited and enjoyed by all human beings and not just a few wealthy individuals and corporations;
- Separating private ownership from shared assets (like the sky, scientific knowledge, silence, the Internet, forests, oceans, ecosystems and our cultural heritage and traditions, for example) thus ensuring protection and management of our common wealth;
- Reinventing current patterns of production and consumption by focusing on shared sufficiency rather than upon selfish excess;
- Restoring functionality and beauty to our lives within limits determined by natural laws over which we have no control.

Essentially these four imperatives equate to society's new bottom line. They are non-negotiable. The real difficulty is that they require us to find ways of integrating and transcending current praxis in order to address more fundamental issues than just climate change or food prices or terrorist activities.

That is easier said than done of course. Political processes continue to stall because of corruption, greed, self-interest and the traditionally competitive nature of many international negotiations. The mass media vacillate, polarise and even resort to inventing the news. Industry leaders sit on the fence, denying culpability, defending current investment decisions, threatening governments with mass job cuts and lobbying for as little change as possible. Investment banks shrewdly manipulate conditions to their advantage – new carbon markets potentially offering billions of dollars to them in profits.

Meanwhile, on the edge of public awareness, numerous activists, each with a slightly different agenda, repeat their doom-laden mantras, confusing the general public who are already fearful and fatigued by the overwhelming social, economic and environmental uncertainties before us.

For the time being all pretence of leadership has been replaced by an oligarchy hell bent on milking every last drop of life from the industrial system even as it crashes. The lack of a compelling and appropriate vision and of a unified global purpose, together with the necessary collaborative will and mechanisms needed to escape the gravitational pull of the past, is deeply indicative of a society lacking the resilience, imagination and consciousness required to adequately transform its state of being.

Over the past few centuries our world-system has advanced incredibly and in so many different ways. Today, those fortunate enough to be living in the developed world enjoy levels of material wellbeing that was unimaginable even a few years ago. At the same time much of what was once fresh and beautiful about humankind has ossified into a rigid shell; homogenous, pitiless, seemingly devoid of empathy, wonder or love. Bloated from excessive consumption, exhausted by pointless conflict, we await a crisis that causes the blueprint of a new society to emerge from the *imaginal* cells of our deepest communion, like the metamorphosis of a chrysalis into a butterfly.

It is quite likely that global heating is that emergency – or will swiftly become so if government inaction persists. Yet, as we know from catastrophe theory, all crises offer us a plethora of possible ways forward. In the context of climate change there are a few critical paths that lead to a better future for humanity as a whole. Others, and I fear these are the pathways we are intent on pursuing, chart a course that lock-in current divisions and convictions – especially the paradigmatic impulse linking progress to continuous economic growth and development.

So what *do* we imagine when we speak of a "better" future? What inspires us about this future? And how does it stack up with what we already have and what we believe we may be about to lose? These are critical questions and we need to find answers fast. Again, integral foresight is an enabler we ignore at our cost.

What if not progress?

At least since the industrial revolution, possibly before, the Occidental mindset has been conditioned to identify progress in concrete terms. By and large material wealth (together with its entourage of

by-products emphasizing status, style, experiences, gadgets and technical wizardry, in addition to the speed and persistence needed to acquire these of course) is what Westerners gauge, compare and value. What is more we have been indoctrinating others into this belief system whenever we have had the chance. We call it progress. It has created immense wealth for some and has been immensely damaging for others.

Ironically, although there is an emerging consensus among psychologists that individual happiness and contentment is what most of us genuinely desire, the factors that might reasonably be expected to provide such fulfillment (collegiality, kinship, reciprocity, peace, the time to do simply nothing, read a book, or walk along the seashore, for example) tend to be valued far less in the West than in places like Iran, India, Indonesia, Bolivia, Cambodia and China.

Measures commonly employed by Western governments, such as Gross Domestic Product (GDP) are widely regarded to be symbolic of a successful economy and hence of a prosperous country. Our collective consciousness remains captive to these viral fictions of economic preeminence, particularly when they become the primary topic of conversation on dedicated television channels like Bloomberg TV or the Islamic Finance TV Network.

But by raising an abstract concept (market economics, for example) to a position above that of tangible human enterprise, where financial frameworks and processes are intended to galvanize, enable and support such endeavors, we have laid bare the desolate nature of contemporary existence.

Thus we commit our lives to accumulating wealth as an end in itself, hardly ever taking the time to fathom how we could use the fruits of our labor more effectively. If this void is typical of individuals and their families in the developed world then it is an emptiness even more apparent at community and societal levels. It is also highly contagious. As a species we seem to have no higher purpose these days other than to keep making money, accumulating additional possessions that we then throw away, and consuming more and more stuff.

It does not take the brain of an Einstein to know that this is the paradigm we need to change. Some of us are anxiously biting at the bit, eager to change things for the better on any number of fronts. Others may need time to be weaned off current addictions and their underlying assumptions. Quite possibly they have more to lose or allow principles of scarcity, rather than of abundance, to dictate their values set.

A new society is struggling to be born – of that there can be no doubt. It needs to be as enchanting as the old as well as triumphing over prior fears, anxieties and phobias. Resilient, too,

and environmentally sustainable. But this new society is contingent upon changed intentions and reinvented outcomes. That means designing it collaboratively and with renewed purpose.

Purposeful design (or *deep design*) targets our collective neural system, exciting our emotions, imagination and aspirations in the fulfillment of a *new* promise to replace the *old*. It is akin to aligning our interior psychological states (in terms both of individual and collective conditions and convictions) with the exterior infrastructures, artifacts, architectures and systems we want to construct.

Integral in nature and displaying a natural integrity, *deep design* is a product of integral foresight, entailing the embodiment of new *values* (enacted through every strata of society – from individuals to institutional and community governance and management structures) and the composition of new *memes* (self-replicating narratives reflecting the advantages to human beings, natural ecosystems and future generations) to reflect new and enlightened *circumstances*.

As for those who bear the responsibility for letting go of a paradigm that has brought so much to so many in terms of material wealth and prosperity, the surfs demand compensation from the elite: for that which we seek must shine with an intense beauty, a liberated civilization where we are able to relate to each other within an ethos of abundance, while assimilating and surpassing the economically-driven, rationally-controlled world of timetables and targets we still find so hard to set aside.

Corollaries

Over the past few decades futures studies and foresight methods have advanced our thinking and capacity to design better, more integral, futures. Now is the time to harness that knowledge, using it more effectively to help transform our thinking. There are two critical aspects to using foresight techniques effectively...

Firstly, we must adopt systemic thinking. Trying to plot a linear course from a dynamic present to a world-changing future can be a beguiling speculative exercise. In practice it is bound to fail especially when we focus solely on the external world of physical materiality but pay no heed to our inner worlds of deeply held values and convictions.

Secondly, the human condition has become far too complicated to fully comprehend and to chart with existing tools, although it is not the long view that is so much the problem as the immediate future. By that I mean the next decade or so. Being caught up in such a convoluted *here and*

now makes any attempt to map short-term future options (at least from our currently prevailing perspectives and altitude) out of the question.

So we become bogged down by the sheer variety and density of factors, forces and trajectories, some obvious but many barely perceptible. Inundated by this data overload (much of it noisy, contradictory and bewildering) we unintentionally infer a chaos from which it is increasingly difficult to extricate ourselves with our sense of rationality intact. In other words we remain trapped within prisons of our own invention.

Integral theories teach us that because of this pervasive complexity in both our outer and our inner worlds it is vital to come to some kind of broad understanding and agreement as to our paramount purpose and intent before resorting to the reassuring routine of detailed planning. But finding such strategic purpose also requires uncovering common ground for collaboration, being clear about our shared aims, and articulating the most critical and desirable goals from an array of latent options.

We know that broadly defining a compelling future, one that is healthier, sustainable and more abundant than present actualities, is critical to progress being made. That means envisaging radically different alternatives, accompanied by a degree of consensus that the futures for which we yearn are technologically achievable, socially desirable, politically prudent, economically feasible and mutually beneficial. Only when this initial work has been done will we be capable of standing in that intended future with confidence, commence the work of designing viable future-to-present pathways[6] and resource local activities that can be leveraged to meet shared aspirations.

Regrettably the majority of in vogue models, methods, practices and initiatives tend to result in rather aimless and uninspiring goals. Too often they lack foresight and clarity around a shared purpose – other than that of avoiding adversity or known problems. And even when that purpose is transparent they habitually neglect expressions of viable pathways to achieve a satisfactory endpoint.

Now is the moment for re-creating strategic foresight in terms of a transformational integral philosophy, not just a compendium of information, trends and tools. There can be little doubt that the genuine transcendence of the civilizational worldview is the most vital yet audacious key towards the intentional evolution of an enduring global community. It is time to reach far beyond the civilizational paradigm with its prejudicial constraints, exploitative traits and profound injustices. Impending panarchic collapse calls for new possibilities, new visualizations, new memes and new strategies. And that is precisely where integral foresight has a unique and enduring niche.

---

6 Often referred to as back-casting.

Who can doubt that this moment in history is unique? Of course exceptional times call for exceptional responses and not simply more of the same. Yet uniqueness of the type now warranted invariably emanates from altogether higher levels of intentionality – from a civilizational consciousness intensely focused on *integrating* and *transcending* past paradigms and poles of thought.

An elemental distinction between societies is whether they accentuate the spiritual or the physical realm. Within pre-literate communities these were (indeed are) identical. Throughout the late 19th and 20th centuries, emboldened by globalized trade and technological innovation, others eagerly embraced the Occidental mindset. Today we sense a less-fractured world, united (at least temporarily) by a common purpose, edging towards a more unified, all-encompassing mindset in which science and spirituality, as well as our internal and external worlds, strive to fuse once again.

What is evolving now though, is not the individual but the composite organism of humanity. Yet until we fully comprehend we are all part of a single living ecosystem, that we are all intimately connected to the Gaian biosphere that gives us life, and that cooperation and not competition is the key to our future existence, we will most likely continue to butcher each other and despoil the planet, like destructive cells in an autoimmune disease.

When a society accepts specific answers to recurrent questions from a particular body of knowledge, they commonly turn to that same source for other truths about reality. In the Middle Ages people asked the local priest or to the Church to help them resolve problems in their daily lives. Prior to that it was the village shaman or the witch doctor. When science eclipsed religion we turned to scientists and technologists for the answers. Now it is time to turn to the custodians of integral thought. To more holistic, more integrated and authentically human states of being.

Within the context of holism, awareness, intelligence and connection are keys to the deeper design of a unified society living in harmony with its environment. Similarly, those belief systems that perpetuate current conditions, exacerbate problems like global heating, that cherish competition and that permit us to pollute and destroy the very things we need to survive, will only go away when we realize we are part of an intricate and delicate web of life.

This understanding, this wisdom of cooperation, is the philosophical vacuum without which any attempt at reform or reinvention is bound to falter and fail.

Ideally the creation of a cohesive, unifying vision for civilizational renewal should be high on the foresight agenda. It should be the most important mission of our global institutions. It is not. In their

current state, orientation and focus, international representative bodies are incapable of conversing at the level required, least of all are they capable of enabling a momentary stay in all the noise and confusion.

Trapped in past paradigms, their utter powerlessness in the face of complexity merely fuels public consternation. And as our united nations are anything but united, their efforts mostly confined to propping up what has been and their shrill utterances increasingly hollow and self-serving in a multi-polar world, a new form of intentional community will need to embark upon this particular mission. In this regard I remain optimistic and I envisage this will most likely be led by a community of practitioners well versed in the subtleties of integral foresight.

What is the future for our civilization? How can we begin thinking like a species instead of self-interested individuals? What do we have that we value in common? What will it take to achieve an authentic community of nations? Above all else, what will it feel like when our systems of governance, finance, production, education and health care all work in concert with one another rather than in competition?

These are such critical questions to ponder as we take the first tentative steps of a new consciousness. In the past few years we have blindly undermined our capacity to shift the acquired, yet damaging, beliefs imprinted within our cultures for something far more sustainable and fulfilling.

It is now time to cast off that old paradigm, re-vitalizing and empowering ourselves, in order to advance towards a new and more compelling reality and to open new windows onto new worlds.

Foresight scenario logics: comparative & combined foresight scenario framing methods to provoke alternative futures

Jack E. Smith*

Introduction

This paper aims to fill a gap in the tool bag of a foresight practitioner – namely the need for a practical assessment of different scenario framing techniques and a coupling of this perspective to the challenges associated with using scenarios to provoke future possibilities that are indeed real alternatives and that represent not incremental but more radical substantial and disruptive change from the inertia of the present.

The paper has been developed for and was presented at the December 16–17, 2010, CGEE, in Brasilia, Brazil.

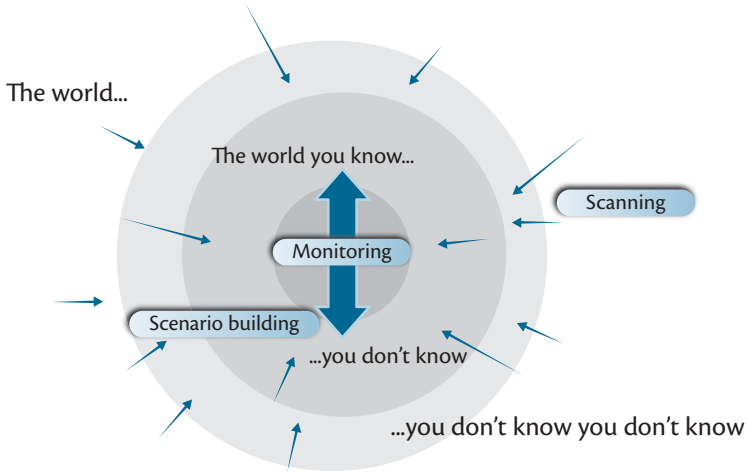
The insights are derived from the author's foresight design and management experience, from inputs and discussions and from relevant literature sources, and from discussions with peers and other experienced practitioners. The paper takes the format of commentary on the slides used for the presentation.

The starting point is about the fundamental uncertainties that foresight must confront, and for these reasons it is important to remember to actively seek to explore the boundaries of our experience by structuring our perspectives from the outside-looking in in addition to our normal inside-out frame of reference.

* Telfer School of Management, University of Ottawa, Canada.

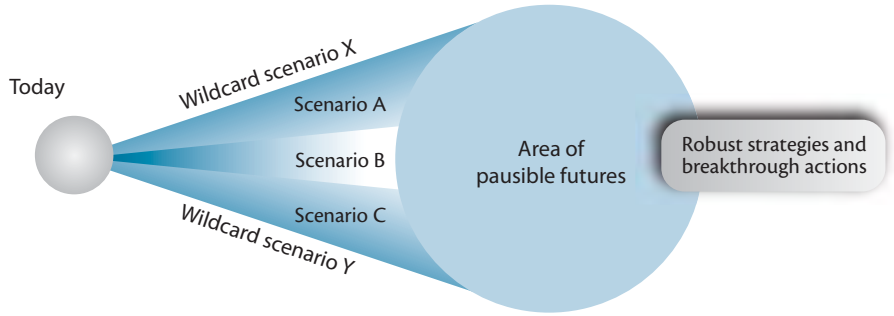
We are trying to plan for:

- *Technologies* that have not been invented;
- *Jobs* that don't exist yet;
- *Problems* that we can't anticipate yet;
- *Applications* that we have yet to imagine;
- *Risks* that we can't quantify yet;
- *Viable systems* that haven't been designed yet and
- *Creative and Systems type thinking*, that most people are not used to doing.



Outside-In rather than Outside-Out

Another way of looking at the challenge is to consider how we need to broaden our frames of reference – where we develop multiple pathways and robust strategies.



How do we mobilize, inspire and align out talents and assets to create the envisaged opportunities and realize the innovations necessary?

Identifying robust strategies

In the experience of Canadian foresight, and in the context of the international track record, government led foresight depends upon a series of critical success factors:

- Focus on a clearly identified client;
- Clear link between foresight and today's mid term policy agenda (3–5 years);
- Direct links to senior oplicy makers;
- Clear communication strategy;
- Integration of steakeholders in programs;
- Provides methodologies – skills that are not always or normally used in other departments;
- Academic receptor – to train and develop skills.

As well, the relationship to policy is also very important- foresight helps policymakers in several ways:

- Reveals issues, challenges-threats, stakeholders, alignments;
- Can anticipate impacts of new, disruptive technologies;
- Identifies needs for new skills, knowledge and capabilities;
- Explores weak signals that can become pivotal in the future, and potentially disruptive surprises, technologies;
- Demonstrates current regulatory weaknesses – zones where failure to prepare can bring severe consequences;

- Can be used to determine S&T, R&D priorities, strategic technology investment domains and critical sectors;
- Delivers intelligence on emerging business and market opportunities;
- Provides alerts about organizational vulnerabilities – allowing time to adapt.

A key tool for foresight, and the focus of this paper is scenario planning. Scenarios are rich stories about multiple, plausible futures, and they are suitable when the following conditions are operative:

Scenario planning

Rigorous approach for

- Managing uncertainties surrounding investment choices;
- Exploring *alternative* environments, multiple futures;
- Focusing on *plausible* rather than *predicted* outcomes;
- Identifying robust problem-solving, adaptative sstrategies;
- Testing which will work "No Matter How the Future Unfolds": readiness *what if* and *how could we...*

Typically chosen when

- Ambiguity in the operating environment is high;
- Pace of change and degree of turmoil is accelerating;
- Planning horizon stretches out to 10 years or more;
- Stakeholders are able to manage coplex, contingent situations and formulate strategies;
- These strategies are aimed at preparedness and identifying opportunity within the accepted uncertainity represented by the divergence of the scenarios.

Another fundamental concept associated with scenarios is the power of scenarios to capture disruptive uncertainties. There are many sources of disruption – some within and others outside of our control.

- **Mind set:** Institutional *Linearity-Rigidity* in assumptions, structures and preparedness strategies; (Maginot Line, Blitzkreig; Vietnam)

- **New models:** e.g. new societal capacities – digital education, *disaggregation of services, social networks*;
- **Technology shift:** Succession–Breakthough, and *transformative technologies*; (Hiroshima; Singularity-quantum-nano-self assembly; synthethic biology, drones-robotics)
- **Arrogance-comfort:** Self *delusive* narratives; (9–11; Global Finance 2008, Iran nuclear)
- **Power of nature:** "Gaia" *planetary techtonics* - Evolutionary – naturally occurring – recurring earthquakes, tsunamis, volcanoes, typhoons, hurricanes etc.
- **Doomsday:** "*Unthinkables*" - horrific, pervasive and complex; comprehensive and costly beyond out capabilities for restoration. (asteroid hit; gulf stream shift, rapid polar melt, nuclear winter, solar flare heat thrust, "grey goo")

And disruptive technologies are also triggers for innovation:

- **Customized materials:** auto design, modelling engineered;
- **Quantum computing:** models that reach beyond Moore's;
- **Singularity systems:** machine intelligence winning;
- **Semantic Internet:** data rich and self navigable;
- **Cyber agents:** sensors for networked intelligence;
- **Autonomic software:** self repair code generation;
- **Stand alone power:** portable, sustainable energy systems for sensors, robotic weapons, intelligent agents;
- **Nanorobotics, nano medicine, nano electronics and self assembled materials and devices:** Smart Dust, linked in colonies;
- **Smart organics:** that upgrade life forms intelligence;
- **Visualization, human-machine interfaces:** linking brains and machine.

What are different ways of framing scenarios?

There are many ways of framing the scenario logics as the Table 1 shows:

Table 1 - Alternative scenario framing bases

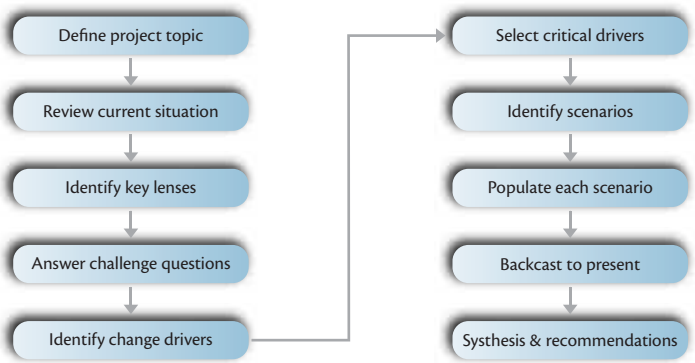
Scenario method	Basics – key characteristics	Notes
1. Axial-2 (AX2)	2 key uncertainities produce 4 scenarios	Can be limiting – requires careful attention in choice of drivers
2. Multiple Axial-2 (MA2)	Select best 5–6 from total of about 8–10 generated by 4–5 sets of axial-3	Opens up process but also demands care in selection – requires more time, imaginative input
3. Axial-3 (AX3)	3 key uncertainities lead to 8 scenarios	Good for complex 3 dimensional, but 8 scenarios can be confusing with subtleties
4. Axial-4 (AX4)	4 axes enable many scenarios	Useful for more exhaustive, analytical and complex work but requires more evidence
5. Thematic Policy Challenges (TPC)	Unilimited range of options, but themes must be broad, resonant	Good link to key receptors in policy, leaders
6. Diverse Dominance Drivers (DDD)	Typically derived from STEEP drivers where critical challenges frame diverse-divergent futures	Allows major institutional interests to be reflected
7. Normative Alternative Preferences (NAP)	Futures we want or can like, selecting for desirable choices and impacts	Inspires creativity but also encourages bias so needs a challenge function
8. Dichotomous Thematic Alternatives (DTA)	Where opposing end states are clearly contrasted – e.g. what is best and worst that can happen	Premised on readiness for opposed outcomes – may require organizational courage
9. Constituent Elemental Forces (CEF)	Where scenarios are developed from the bottom up in pieces and assembled into coherent stories	Requires skilled foresight team – but can be quite effective
10. Computational Probability Algorithms (CPA)	Number os alternatives defined by system capacity	Must have strong computational models and teams – or funds to acquire

Because foresight is a relentlessly emergent phenomenon, there are macro trends that are shaping the future. These are used as lenses. The challenge for foresight is that it evokes possibilities outside of the imagination and experience of many participants:

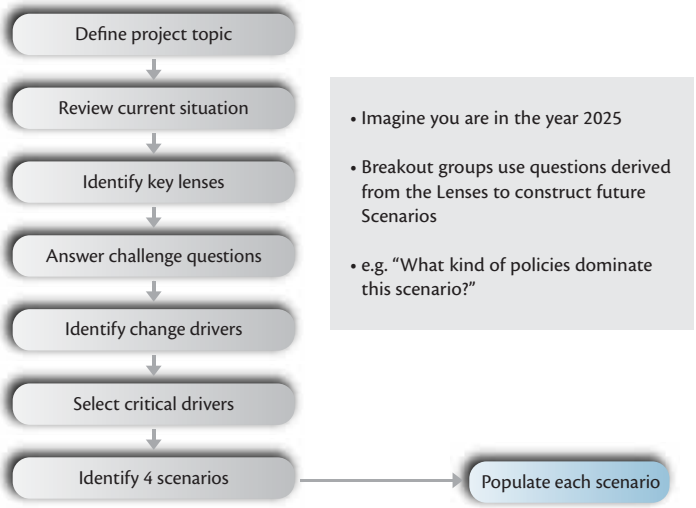
- **Ambient intelligence:** progress toward the singularity;
- **Global anxiety:** from global warming-climate change to terrorism;
- **Virtualization, digitalization and integration:** of business-professions, production, communications, entertainment, education;
- **Miniaturization and socialization:** of technology;
- **Globalization:** of Capital, terror, disease, eco-environment;
- **Anti-globalization:** of biodiversity, culture, sustainability;
- **De-Carbonization:** of energy economy;
- **Harmonization – Standardization:** for trade;
- **Migration, multi-culturalism:** of populations;
- **Intensification, differentiation:** of wealth;
- **Transformation:** of infrastructure systems;
- **Acceleration of knowledge:** services as economic driver;
- **Proliferation of surveillance:** security.

Systemic foresight process and foresight integration

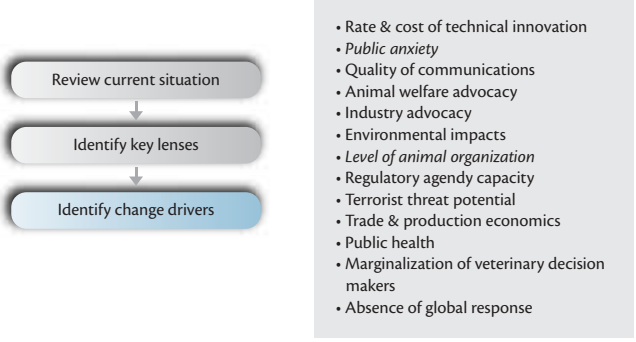
As foresight practice has evolved, become diversified and involved many more participants and approaches during the 1980s till the present, it has emerged that the most dynamic and insightful activities are those that have required the use of multiple tools and approaches – usually starting with some sort of scanning, including a research or mapping phase and then either moving into scenarios, expert panels or one of the more analytical and modeling tools.



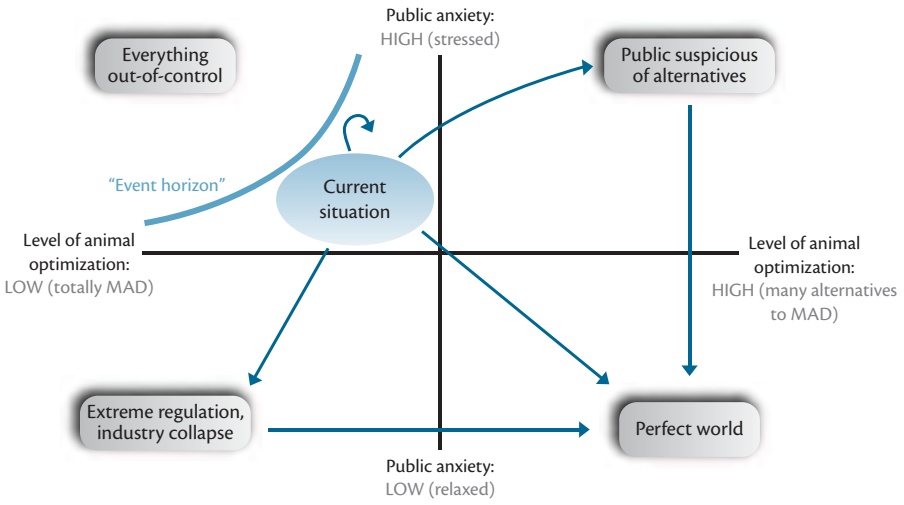
Foresight process overview



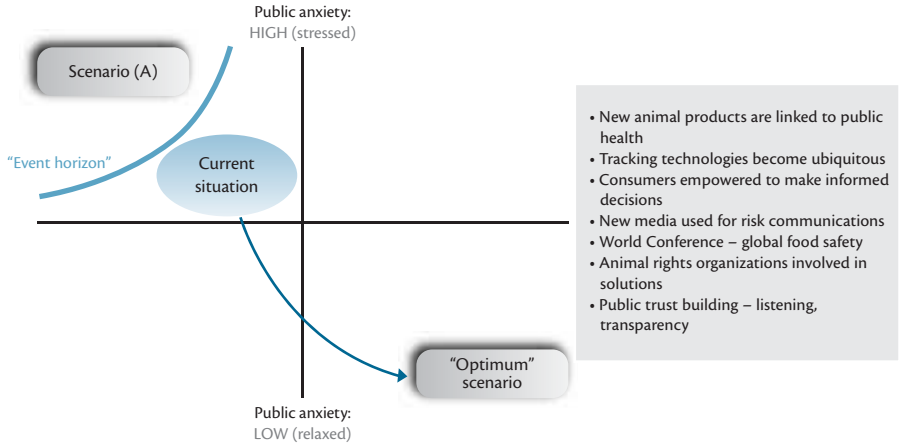
Scenarios centric foresight process



Animal health drivers example



Driver axes (MAD=Mad Animal Destruction)



Driver axes scenario A

Other scenario methods

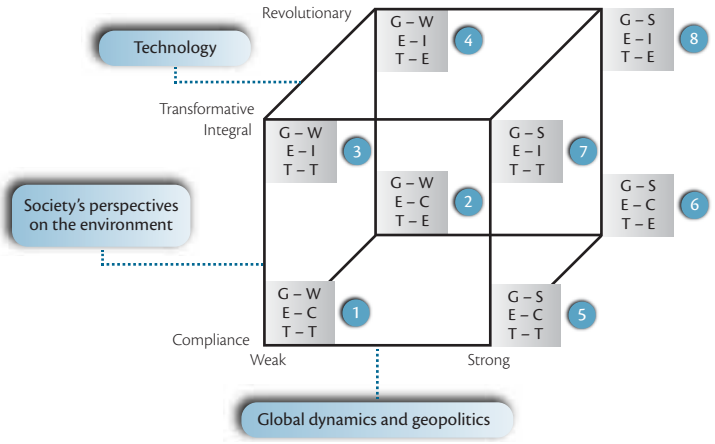
The double axial method allows foresight to move from where we are now to a range of plausiblefutures. The narrative will include measures as well as repositioning strategies.

Triple Axial: three critical uncertainities

Of the 6 future drivers, 3 critical uncertainities were identified as most important:

1) Global dynamics and geopoliticial relations;
2) Society's perspectives on the environment;
3) Technology.

Understanding the influence and range of outcomes for each critical uncertainity is improtant to developing challenging scenarios for resource processing industries in Canada.



The Scenarios Cube

The Scenarios Cube shows us how three critical uncertainties – triple axial – can enable at least 8 scenarios. The advantage is more frames and more complexity. Here is an example:

Scenario #7: Rising tide, sinking ships

- Strong global dynamics and geopolitical relations
- Integral perspective on the environment
- Transformative technological change

Society's behavior is changed resulting in a decrease in consumerism and a premium placed on knowledge. New technologies are developed that support this changing attitude.

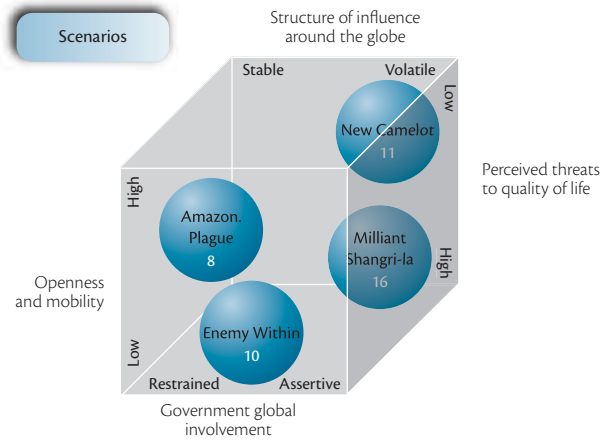
- An environmental disaster causes a fundamental shift in social values, which serves to unite the world and spark innovation
- The economy shifts to a knowledge-based economy
- Global consumers move away from an ethic based on consumption
- Network-connected youth drive the economy further through cyber consumption

Examples of thematic scenarios

Possibly thematic scenarios analysis		
Prospective Thematic Title	Key Uncertainties Addressed	Comments
Aboriginal youth		
Forging ahead		
Treading water		
Lost in legality		
Urbanization		
Global suburb		
Stretch out - slink in		
Good, bad and ugly		
Local distemper		
Cocoon of challenge		
Incapacity		

Continuing pag. 85

Possibly thematic scenarios analysis		
Prospective Thematic Title	Key Uncertainties Addressed	Comments
Income inequality		
Carry that load		
All for all		
Cyberia		
Underclassification		
Segments and fragments		
Aging		
Half empty, half full		
Move on boomers		
Grey regenerates		
Young avatars		
Multi cultural integration		
Global gateway		
Losing the edge		
Haven of choice		
Global reach		
Those people		
Integrated		
Cup is half		
Agile Mosaic		
A fractural future		
Drawing down the legacy		
Moping along		
Hyper Shift		
Rubric's New Cube		



Four axes: populating the protean environment

Protean critical thinking – new tools for foresight

- **Proteus is a set of foresight tools premised upon asymmetries** of action, intent and impacts, aimed at exploring unforeseen implications and consequences of actions undertaken under conditions of threat, surprise, disruption and disorder;
- **Proteus has codified the insights into forces, actions with consequences.** As institutions, authorities and empowered individuals seek to re-establish or create new equilibrium situations they effect Portean action-reaction and power relations by selecting strategies based on Protean insights – resulting in consequences and adaptative learning.
- **Proteus has developed a gaming platform to enable actors to learn about contigent actions.** *Proteus Critical Thinking* is a game of roles and strategies which has been designed to address complex multi-factorial threat, opportunity and renewal situations.

Proteus insights for 2020

Starlight: "Foresight and uncertainity management"

- Today's technologies and methods tend to focus strictly on events, which have already occurred

Sanctuary: "They *can* run and they *can* hide"

- The ability to hide discrete events and broad tends despite ever-increasing globalization and worldwide connectivity

Sweat the Small Stuff: "Cyber beings, biotech, nanotech"

- The double-edged sword nature of cyber technology, biotechnology, and nanotechnology; macro-effects will result

Veracity: "The challenge of truth and knowledge"

- In a future of complex, interconnected global networks where the speed, pace and rate of change challenges the importance of "truth" – authenticity becomes elusive, sometimes irrelevant

Power: "The shadows in Plato's cave"

- If our focus is only on the instruments of power instead of the values from which they spring, we risk strategic surprise

Wealth: "It's not just money"

- We need to understand the flows of non-traditional currencies (*e.g.* knowledge, safety, health, genes, personal networks)

Herds: "People and ideas on the move"

- Nature of people and groups (theirs ideas, beliefs, loyalties and affinities) is complex, dynamic-workforce implications

Parallel Universe: "From networks to cyber life"

- Cyberspace becomes less a communications network and more a parallel universe coexisting and influencing every aspect of the physical world

Bedfellows: "The significance of teaming"

- The need for organizational agility ÿ new partners, new customers, new relationships and new appreciation for the speed, rate and pace of change

Starlight: "The obverse of opportunity"

- Our groups had a propensity to find – or even create – traditional threats. In doing this, they tended to either miss or misconstrue the non-traditional threats – and the corresponding opportunities – *in all of the venues*.

Scenario planning references

Reference title	Author	Source
Foresight: the art and science of anticipating the future	Loveridge, Denis	ISBN 978-0-415-39815-2; by Routledge 08/11/2008
The art of the long view	Schwartz, Peter	ISBN 0-385-26732-0 ;New York, NY, Doubleday Currency, 1991
Inevitable surprises	Schwartz ,Peter	ISBN 1-59240-027-2; by Gotham Books, Penguin, New York, 2003
Scenarios: the art of strategic conversation	Van Der Heijden, Kees	New York, NY; Wiley, 1996
Scenarios: uncharted waters ahead, and Scenarios: shooting the rapids	Wack, Pierre	Harvard Business Review, v.63, n.5, p.72–89, Sept/Oct. 1985; and Harvard Business Review, v.63, n.6, p. 139–150, Nov/Dec, 1985
Creating better futures	Ogilvy, James	ISBN 0-19-514611-5, New York, NY. Oxford University Press, 2002
Changing the winds – scenarions for people who want to change the world	Kahane, Adam	Whole Earth, Spring 19999, pg 82ff
From my perspective: scenario planning	Coates, Joseph	Technological Forecasting and Social Change: Volume 65, Issue 1, September 2000, p. 115–123
Scenario Planning bibliography	Van der Heijden, Kees	Global Business Network: *http://www.gbn.org/scenarios*
Scenario Planning – managing for the future	Ringland, Gill	ISBN 0-471-97790-X, Wiley, New York 1998
Scenario Planning handbook	Ralston, Bill and Wilson, Ian	ISBN 13-978-0-324-31285-0; Thompson Higher Education, Mason, Ohio 2006

Conclusions

Scenario planning has many variants and an extensive body of experience to draw upon. This paper has briefly examined five of the ten methods referred to on page six.

The above review of tools and systemic factors and perspectives has been designed to highlight the directions that S&T foresight is moving and has to move further in its ongoing evolution as a thriving, emergent and convergent field of learning and strategy, policy and action. An expert assessment is that integrative, systemic foresight, combining multiple perspectives and tools will be the dominant pathway toward the future.

As that future grows ever more complex and challenging, the tools will need to become more powerful and consistent, with protocols likely to emerge with respect to how combinations of: computational power, new insights into how humans cope with change, and impact understanding through dynamic simulation sequencing can begin to deliver real adaptive and futures guidance to society with respect to both major actions and contingent investments that we as a society need to make to realize emerging opportunities.

In conclusion two critical points are re-iterated: first foresight and scenarios should be provocative to engage their intended clients and second, enable communications to play a strong role and also pay due regard to all the other *key C* considerations listed below.

Provocative

Foresight really is about moving out of the present and into the exploration of uncertainity in the context of a different time and era, and so it needs to consciously define assumptions about change – otherwise it will not be credible.
Provocative capacity can be developed by creating internal challenge processes, by adding outside experts and by introducing bold ideas, new ways of seeing the future and wild cards or prospective shocks that create dynamics or faster and more profound change.

To conclude there are some additional insights, all bound by the *letter C* – consisting of those aspects of S&T foresight management and tools deployment that every practitioner should be reminded of when planning future foresight projects:

1) Foresight is first and foremost about learning to understand *Change* – and thereby to better anticipate the disruptions and opportunities it may deliver;
2) Foresight requires *Commitment*, *Clarity* of purpose and appreciation by the players and the sponsors so that its capabilities can be realized;
3) *Champions* are necessary – they signal relevance and forward readiness to embrace the results – otherwise a sense of futility abounds;
4) Good foresight is fundamentally *Collaborative* – i.e. the real synergies lie with those who are collectively sharing their insights and stimulating each other – and the presence of these collaborators is also essential for its *Credibility*;
5) Foresight is a participant activity – not a spectator sport and people want it to be a *Consultative* process and have their ideas *Considered*. – i.e. we are all stakeholders in the future;
6) Foresight is more about *Conversations* and rich stories about varied dimensions of life experience than just analytics or data- after all there is no real data on the future, just projections, assumptions and implications from present data;
7) *Computation* and simulation are however becoming indispensible for managing the complexities of future variables and the enormous range of drivers, factors and implications we are finding applicable to the scale of foresight challenges;
8) And yes *Challenging* Convention, and being or at least including some iconoclastic perspectives is useful to ensure reasonable variety ;
9) To extend this aspect, of the importance of variety, good foresight needs diversity and multiple, plausible alternatives that explore the dynamic edges where change is most active -because quite often our experience has been that the most astute insights arise from explicitly *Critical* thinking.
10) This in turn contributes to the process being designed to encourage *Creativity* – which becomes a key asset to the project, especially in attracting creative individuals
11) This being said, foresight also needs to record, *Capture* and evaluate the information it generates – otherwise much of the value will be lost;

12) And to best enable good capture, the use of the tools described above should be both *Concurrent and Connected* - whereby multiple tools enable participants to share different aspects of their knowledge and experience;
13) Finally – it is ultimately about *Communications* – at every level and covering strategy, delivery, and follow up-action.

Strategic foresight: building a roadmap for transformational innovation

*Howard Rasheed**

Innovation is the new imperative of the future global economy. In other words, you must – innovate to win! Innovation has become the new national comparative advantage and the new core competence of world-class organizations. Whether you are in the business, government, or the social sector it is clear that being more innovative is the key to prosperity and your organizations' competitiveness.

Many people in the United States of America lament over its declining position in the world economy. Many statistics point to a decline in the USA dominance in the world economy as a result of challenges in production cost competitiveness and the democratization of intellectual capital among emerging economies. So what is to be done to "right the ship"? Or are America and its Western cultural allies doomed to the fate of other fallen empires like the Egyptians, Persians, Greeks, Romans, and British?

What is needed is a global innovation renaissance. A renaissance is defined as a rebirth or revival, e.g. of culture, skills, or learning what was previously forgotten or ignored. As this innovation renaissance evolves the question is who will be the major players. Many point to the growing economies of the BRIC, more specifically Brazil, Russia, India, and China as example of rapidly growing economies that have strong potential for winning the future. In order for other emerging economies to be relevant in this seismic shift in the global economy they need purposeful and planned innovation renaissance. Governments that proactively create think tanks in which thought leaders develop strategic foresight studies and road maps for transformation innovation will undoubtedly be successful in the future.

* University of North Carolina Wilmington and Institute for Innovation, Inc

In a recent Strategic Foresight Conference[1] held in Brasilia, Brazil, a number of world experts presented concepts on foresight and innovation.[2] I will attempt to summarize some them and offer recommendations on how to actualize them as best practices in strategic foresight. I have grouped these ideas into four categories: knowledge, people, process and technology. In the category of knowledge the experts suggest the following:

1) **Knowledge:** Efforts to discover knowledge must evolve from data hunting, management and sharing. Methodology is needed to help foresight specialist change information into strategic intelligence. New knowledge creation must focus more on what we don't know.
2) **Cross disciplinary trends:** Knowledge creation can be enhanced by analyzing trends, predictions, and emerging issues from varied disciplines and subject areas.
3) **Break/Challenge mindset:** Focusing on conventional drivers yields conventional ideas. Find ways to think outside the box using trans-disciplinary knowledge and cross-disciplinary groups.

One of the areas that gain considerable consensus was how thought leaders are engaged in the strategic foresight process. The experts suggested the following:

1) **Create uneasiness:** Avoid what is comfortable and familiar to achieve innovative foresight.
2) **Remarkable people:** Get remarkable people involved to get remarkable results.
3) **Appropriate mix:** An appropriate mix of people means striving for diversity in terms of ethnicity, gender, occupation, hierarchical status, and functional responsibilities.
4) **Innocent people:** Involve "innocent people" who are not traditional stakeholders and that are not bound by traditional paradigms and thought processes.
5) **Creative competence:** Make creativity a competence by finding ways to stimulate and reward creativity as a valued competence.
6) **Preparation:** Prepare participants involved with strategic foresight activities using psychological tools and assessments.

Another key area explored by the experts was the development of a systematic foresight process. Some of the ideas presented include the following:

1 Foresight International Seminar: From Theory to Practice, sponsored by Centro de Gestao e Estudos Estrategicos (CGEE), Brasilia, Brazil, December 16–17, 2010.

2 Insert list of presenters and their credentials.

1) **Methodology:** Brainstorming and foresight activities must be systematic and participatory.
2) **Real-time Delphi:** Create a real-time Delphi environment that provides a collaborative technology or platform that allows continued and structured dialogue among subject matter experts.
3) **Brainstorm technical applications:** Spend quality time and effort brainstorming applications to new and old technologies, rather than just research and development of new technology.
4) **Transformational foresight:** Focus on foresight activities that have the potential to transform society, economies, technology, and organizations.
5) **Out-of-the-box thinking:** Use thinking mechanisms that are unconventional to generate unique ideas.
6) **Decision Theater:** Provide a platform for making decisions that allows us to better visualize complexity in a real-time, crowd sourcing environment. This foresight platform should include a databank of knowledge.
7) **Social networking:** Use social networking tools to improve interaction and collaboration of thought leaders.
8) **Convergence of drivers:** Focus on the intersection of drivers and trends to uncover many permutations of future possibilities.
9) **Wildcard scenarios:** Consider the wildcards, but resist becoming preoccupied with the wrong things.
10) **Provocative scenarios:** Construct provocative scenarios to stimulate interesting ideas.

The preceding list of ideas creates a strong platform for designing strategic foresight conferences and developing foresight processes. These ideas can be summarized to suggest what is needed a strategic foresight system that…

1) Transforms foresight into innovation;
2) Stimulates imagination and interaction;
3) Engages people in a way that is systematic and iterative, not random or serendipitous;
4) Uses visuals and graphics to focus attention on key information;
5) Collaborates via social networks and crowdsourcing platforms;
6) Involves the right interdisciplinary people;
7) Accumulates and shares future-focused knowledge using collaborative technology;
8) Systematically generates new ideas for technology and application;
9) Discovers solutions that have major impact on societal challenges;
10) Provides a roadmap for anticipating emerging business opportunities.

The next section offers strategies that address the suggestions presented at the conference. These ideas were presented by the author based on a system and softwared called the Idea Accelerator. This methodology has been used by CGEE in two previous studies on Advanced Materials and the Photovoltaic Industries.

Collective intelligence methodology

A new and emerging organizational leadership role is that of *Innovation Strategist* – someone who can lead organizations into a new economic reality in the future economy. In the role of leading an innovation renaissance, the Innovation Strategist will become the catalyst for strategic transformation in all industries and organizations around the world.

This article discusses a 7 Step Collective Intelligence methodology that can be adopted by an Innovation Strategist to make a significant contribution in the pending innovation renaissance, as a part of a core competence of innovation leadership.

1. Innovate or perish

First, as an Innovation Strategist, you must understand the urgency of creating and implementing an innovation strategy that is transformative. The need to innovate for global competitiveness is not a challenge that is going away with a few slogans or an overnight remedy. It is a complex problem with no easy answers. As a leader you need to be personally prepared to be creative. But you must also realize that creativity alone does not generate value. You must convert creative ideas into inventions and solutions in order for it to be consider an innovation.

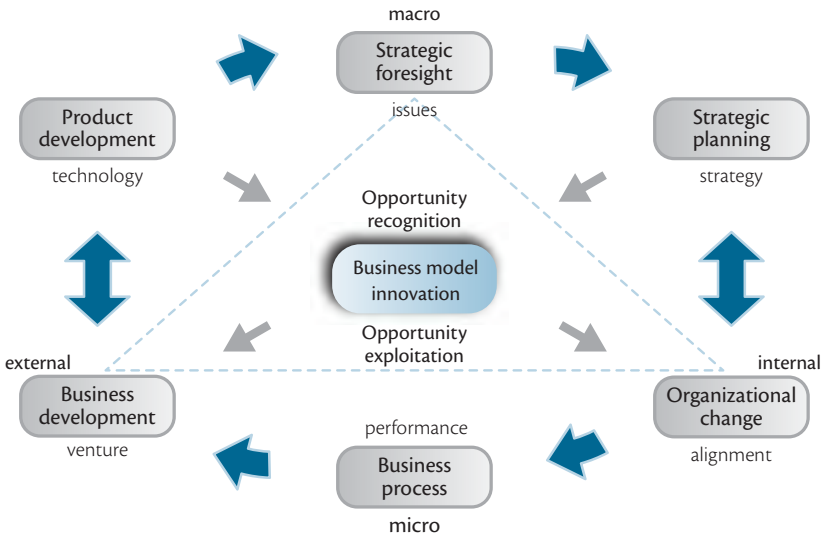
2. Intentionally create disruption

Secondly, the Innovation Strategist must intentionally create disruption in their environment as a new paradigm of innovation strategy. My upcoming book *Innovation Renaissance* uses a metaphor from nature called Creative Disruption for sustainable foresight innovation. This paradigm shift in innovation strategy suggests that the Innovation Strategist should proactively create disruption in their environment to create new opportunities. As an evolving innovation strategy, Creative Disruption assumes that:

- Innovation can be holistic rather than focused on disruptive technology.
- Innovation can be incremental as well as disruptive and disruption can be creative as well as destructive.
- Innovation can be proactive rather than reactive.
- Innovation can be systematic rather than random.
- Innovation can be collaborative rather than the work of a solo genius.

3. Develop a transformational innovation strategy

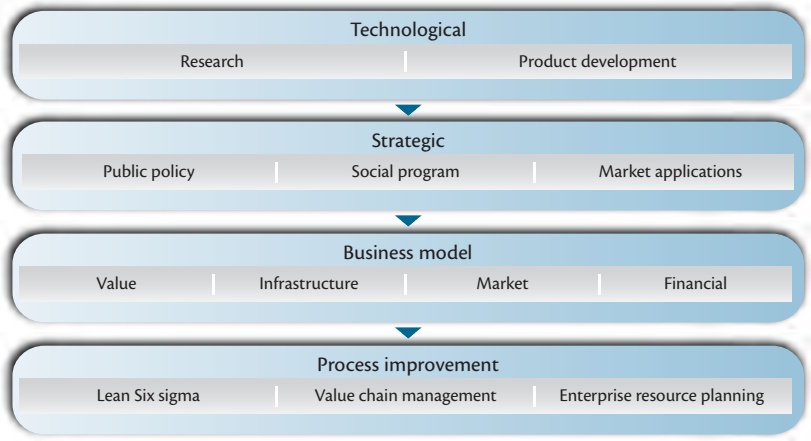
Our old ways of looking at innovation is limited to technology research and development. Although this can be a primary source of disruptive technology, innovation can occur on many levels. As mentioned before, to be effective, strategic foresight must be transformational. We introduce the concept of the Strategic Transformation Paradigm. In this paradigm strategic foresight is performed by government entities or think tanks to look at the macro level vision of a society, nation or region.



Strategic transformation paradigm

The strategic foresight activities help to inform the product development and strategic planning activities of planning agencies and businesses. The output from this process is often a technology road map or a strategic road map depending on the emphasis.

In order for innovation to become transformation we need to move beyond R&D and discover opportunities for creating disrutpion at all levels. In the Hierarchy of Innovation diagram it can occur at the Technological, Strategic, Business Model, and Business Process levels.



Hierarchy of Innovation

4. Develop an innovation culture

Fourth, you must prepare for innovation by retraining yourself to be more creative and create an innovation culture. Ground your thinking with principles of innovative leadership. This includes having a holistic, proactive and systematic approach to creativity. In my first book *Yes You Can, Achieving Greatness While Realizing your Human Potential*, the chapter entitled "*Opportunity Never Knocks: The Power of Innovative Leadership*" presumes that opportunity does not knock – not even once. I suggest that recognizing opportunity is a proactive and perpetual process of creativity. The ability as a leader to have the vision to see opportunities and convert them into value is the essence of being an innovative leader. The Innovation Strategist will:

- Understand that creativity is the precursor to innovation.
- Realize that there should be a holistic approach to innovation should go beyond the research and development of breakthrough technology.
- Accept that innovation is not the sole province of technologist, but can be part of developing human capital and organizations at every level and every sector.

As an Innovation Strategist you must establish an innovation culture in your organization. This requires some of the following activities:

- You must also be in a position to inspire creativity in others.
- Create a cross-disciplinary environment for collaboration.
- Expand your scope of collaboration from internal to external stakeholders.
- Provide crowd sourcing processes and tools to encourage collaboration.
- You must develop and retain human and intellectual capital among your stakeholders
- You must inspire collaboration with incentives, tools, and systems that facilitate the innovation process.
- You must continuously challenge stakeholders to refocus their attention on new knowledge that has relevance to creating a new future.

5. Implement an innovation system

The fifth strategy is to implement a holistic innovation system. At the Institute for Innovation we have developed a 7 Step Collective Intelligence system. This is an attempt to provide a systematic approach to breaking and challenging existing mindsets that leads to an innovation culture. These include the following:

Step 1: Assess your innovation stakeholders

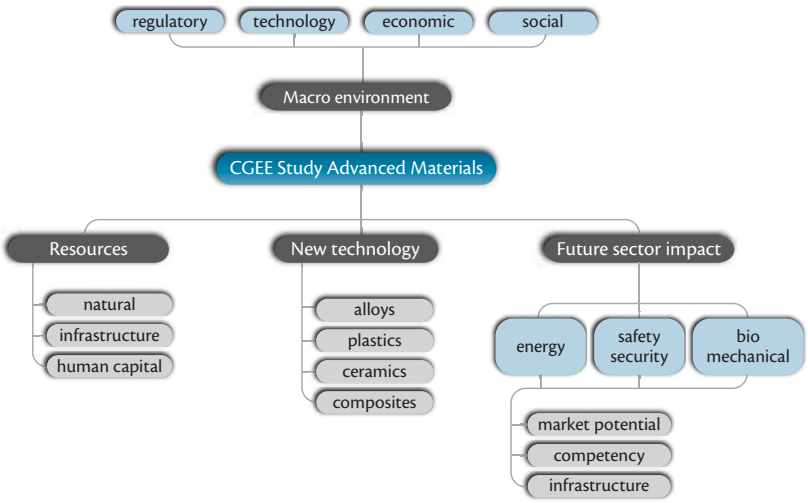
One of the recommendations from foresight experts was to use psychological tools to assess and prepare the participants in your innovation or foresight project. At the Institute for Innovation we use an instrument called Innovation Style Assessment. This tool uses combinations of four dimensions of innovative thinking: visioning, experimenting, exploring and modifying to create 8 distinct profiles. This assessment measures what your typical approach to problem solving and idea creation. It helps with what the experts suggest in terms of getting the right people that represent a diverse disciplines and help them create a new mindset.

Step 2: Visualize your environment

The second step is visualizing your environment using the concept of focused attention that has evolved from cognitive psychology theory and recent neuroscience research. Focused attention is the cognitive process of selectively concentrating on one thing while ignoring other things. According to an article written by Rock and Swartz[3] human cognition is enhanced by focusing attention on new information, thereby creating new neuron pathways. This overcomes the natural tendency toward resistance to change.

Focused visualization is the ability to respond discretely to specific visual, auditory or tactile stimuli. Focused visualization builds task consensus using mind mapping techniques to visualize the organization's environment, strategic goals, operational issues, and desired outcome.

Our methodology applies focused attention on the organization's environment and desired outcomes by using visualization prototyping techniques. Visualization prototyping uses mind mapping software to generate diagrams that represent classification and relationships of key concepts or idea. Creativity is thereby enhanced by creating a graphic structure for ideas. The figure below illustrates a map used in CGEE study on Advanced Materials that provided a graphic road map used in the planning stage of the foresight conference and study.



CGEE study on Advanced Materials

3 Rock and Schwartz, 2006, The Neuroscience of Leadership, strategy and business, Booze, Allen and Hamilton.

Step 3: Explore dynamic knowledge

A unique contribution of this brainstorming process is concentrating research and environmental scanning efforts on future-focused information, we call "Dynamic Knowledge". This fits with the experts' suggestion on focusing attention on cross disciplinary trends and driver.

Historically, knowledge has been defined as tacit knowledge that resides in the minds of individuals and explicit knowledge that is articulated, codified and stored in organization media. These definitions of knowledge only depict static information in dormant environments. In reality, knowledge systems are a dynamic and complex interaction of multi-disciplinary units of information within an environmental context. By focusing attention on information that is dynamic, i.e changing and relevant to the future, our foresight efforts incorporates strategic intelligence rather than historical information.

Dynamic knowledge is observed phenomena that has future implications such as prevailing trends; emerging issues, and expert predictions. Dynamic knowledge research scans the multi-layers of the environment for information that is characterized by vigorous change. When described in quantitative terms this is information has movement that can be expressed as the rate of change in value and represented as the slope of the curve of measured observations. The direction of change can be expressed as a scalar value. The magnitude of change can be quantified in terms of sustained patterns in units of time and represented by the length of plotted vector.

Step 4: Discover future possibilities

The experts also suggest looking for wild cards and out of the box thinking. In our methodology this involves analyzing the convergence of trends and drivers. One of the unique contributions of this methodology is a proprietary process called bisociative brainstorming®. This is an emergent and exponential ideation process that anticipates possible future outcomes by considering the most likely convergences of dynamic knowledge. The infinite possibilities of opportunities and challenges are discovered from the permutations of dynamic knowledge intersections using the theory of bisociation. This unique blend of divergent and convergent thinking methodologies enhances creativity that "connects the dots". Unlike other thinking models, this approach connects the dots from inside and outside different boxes. By considering future-focused knowledge from disparate domains, thought leaders can anticipate the many permutations of possibilities for economic, societal, market and technological disruptions.

Step 5: Innovate new ideas

The innovation process suggested in this methodology starts with a systematic approach to encouraging a culture that challenges old mindsets and fosters imagination and creativity. Foresight can be transformational through the discovery of new ideas that are the result of recognizing opportunities that resolve, take advantage of, or mitigate future possible disruptions. Transformational innovation requires the conversion of the output from the creative process we have described in the first four steps into solutions that create value. This includes discovering applications to new and old technologies, in addition to our current emphasis on research and development of new technologies.

Previously we discussed the "triangle of opportunity." Strategic foresight efforts are the result of brainstorming and ideation focused on macro issues. Think tanks for international and national development agencies focus on "big picture" issues such as poverty, the availability of clean water, security, health epidemics, and global competitiveness. Regional development agencies focus on education, workforce development, infrastructure, economic competitiveness, and health care. Organizations develop strategic plans that identify their long term goals and objectives to achieve their vision and missions.

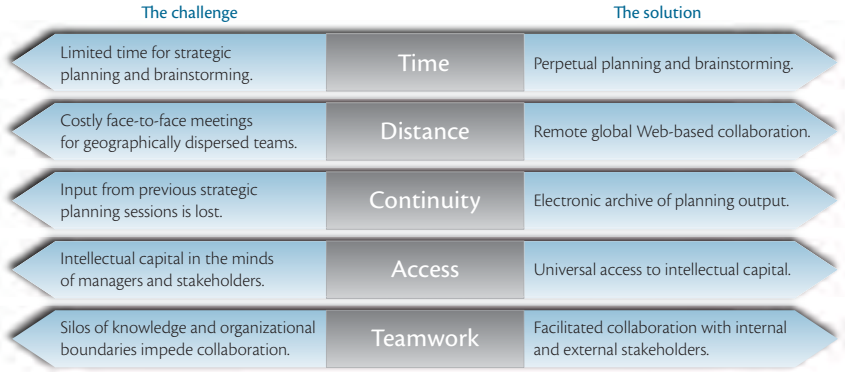
From each of these perspectives, the key is innovation. Not just R&D as stated earlier but new ideas that can create value from opportunities recognized at every level. By perceiving innovation in a broader sense it can include new initiatives, products, technologies, and strategies that can be actualized to create value.

New ideas evolve from systematic and focused attention on the most relevant and probable opportunities and challenges discovered in previous steps. The ideation evolution process is based on the concept that the best ideas are iterative, with each version an improvement of the previous, until the final solution is optimized.

Step 6: Innovation 2.0

The sixth strategy is to develop and implement a technology platform for crowd sourcing that can mitigate the constraints to collaboration innovation as indicated in the following diagram. This strategy addresses a number of the recommendations of the conference subject matter experts such as developing:

- Real time Delphi
- A decision theater
- Social networking for improved collaboration



Constraints to collaborative innovation

The Idea Accelerator system is enterprise-level group intelligence software that facilitates ideation by thought leaders, provides an electronic databank of strategic knowledge and provides a platform for collaborative innovation interaction. It helps strategic foresight organizations overcome the contraints of time, distance, continuity, access, and teamwork.

Step 7: Measuring effectiveness

The seventh step is to develop a system of measurement. Innovation has historically been measured by the number of patents filed which is limited to disruptive technology. Another measurement, return on investment requires a very long incubation period of product development, product launch, diffusion and market penetration. To measure innovation effectiveness at the business model level we have adopted a version of the Balanced Scorecard. The Innovation Balanced Scorecard allows us to develop metrics that can measure progress from learning, organization, market, and financial perspectives.

By adopting these few critical suggestions you can assume the position of Innovation Strategist in your organization. Whether your role is formal or informal, the world and its global citizens need

you to "step up" and lead the Innovation Renaissance. The next section describes a typical Strategic Foresight Conference using the Institute for Innovation methodology incorporated by CGEE for past foresight studies.

A Strategic Foresight Conference plan

A Strategic Foresight Conference is typically organized to explore growth opportunities for a particular sector or industry, as initiated by a government agency or industry association. The output from a foresight study is a macro-level technology or strategic road map for the development of a national or regional economy. A technology road map can help business and technology sector focus on research and product development. Strategic road maps can help businesses and financial institutions develop plans for new market and new venture development. Such an effort is most effective when it includes a diverse group of scientists, business leaders and entrepreneurs, policy-makers, and social scientists to brainstorm ideas and solutions to key issues. A very general list for Strategic Foresight may include the following:

- Improve nation's comparative advantage and trade accounts
- Reduce national deficits
- Improve government efficiency
- Improve regional competitiveness
- Improve technology transfer to commercial sector
- Improve sustainable energy sources
- Improve quality of environment
- Reduce energy consumption
- Create programs and initiatives for improving the quality of life of citizens
- Produce studies and reports for planning agencies
- Explore competitive dynamics of industry

In the case of CGEE, Project Managers develop a project plan in response to an initiative which is often initiated at the request of a cabinet level government. A planning committee is formed to review the intellectual capital database, identify technical subject matter experts, and collect or develop reports on the sector.

The project team can conduct an initial Delphi session brainstorming session with planning committee of subject matter experts to identify more specific themes. Survey instruments, literature reviews, and brainstorming sessions can be used to dive deeper into topics. Follow up meetings to the real time Delphi session can be conducted using the web conferencing, mind mapping, and strategic visioning collaborative tools in a virtual environment. Typical conference planning stages are indicated as follows:

Preconference

1) Instruct each plenary session speaker to provide 10 key trends for the future in an electronic version of Power Point slides.
2) Input all key trends into the Idea Accelerator database.
3) Have the planning committee review and evaluate trends using Idea Accelerator software.
4) Produce top trend cards for use in the brainstorming phase of the strategic foresight workshop.

Sources of research can include:

- Industry reports
- Technology reports
- Foresight studies
- Strategic plans
- Industry reports
- Intelligence reports
- Academic journals
- Call for conference papers
- Call for technical proposals
- Conference presentations
- Newspaper and journal articles
- Website
- Blogs
- Newsletters
- Book summaries
- Internal and intra-net documents

Conference set up

1) Participants complete Innovation Style assessment tool and receive individual report on how they typically solve problems.
2) Conference administrators review participant data and form groups to ensure discipline and innovation style diversity.
3) Registrants self-identify their stakeholder group and register for innovation workshops.
4) Provide badge color dots to identify stakeholder group and/or innovation style.

Strategic visioning process

1) Participants break-out into "solutions teams" for each theme. Stakeholder diversity is preferred.
2) Session recorder documents brainstorming ideas using laptop version of mind mapping software to gain consensus and visualize the issues.
3) Use our methodology to discover opportunities, challenges, and innovative ideas using our proprietary trend database and bisociation brainstorming techniques.

Organizing solutions teams

1) Facilitator reports ideas with recommendations.
2) Participants use a print out to rate ideas and provide comments.
3) Scenarios are written by solution teams and presented at the closing session.
4) Initial road maps are developed to identify gaps in terms of intellectual, human, organizational, and financial capital.

Innovation 2.0: Virtual Think Tank

1) Institute for Innovation will provide an online crowd-sourcing platform for continued interaction of solution teams.
2) Institute for Innovation can facilitate online collaborative innovation sessions with our team of Certified Innovation Strategists to coach solution teams.

3) Solution teams continue to develop new ideas using software with conference output and database on trends and public-private business models.
4) Final reports can be developed using printouts from Idea Accelerator that summarize all trends, drivers, opportunities, challenges, ideas, scenarios, and evaluative comments that have been identified as part of the valuable solutions.

Conclusion

This purpose of this paper is to explore ideas on how the foresight process can be an integral part of transformational innovation. As indicated in the first section, the International Foresight Conference sponsored by CGEE brought several foresight experts together. This paper summarized some of the key recommendations and reviewed some of the innovation strategies used by the Institute for Innovation in their past foresight studies with CGEE. The presentation of the 7 Steps to Collective Intelligence methodology used in the Idea Accelerator software was intended to address many of the recommendations provided by the experts.

Of course it would be presumptuous to assume that the methodology presented captured all of the subject matter experts' recommendations. It is also not assumed that this methodology fits all foresight activities and requirements. Considerable research still needs to done to confirm that the ideas generated from this methodology could not have been developed using other techniques. For example, future research should address the question of whether bisociation generates higher quality and more comprehensive ideas and solutions.

By reviewing the list of recommendations a case could be made for preliminary indications that many of these expert suggestions are at least addressed by the methodology. This paper can serve as a white paper for how planning agencies in emerging economies can develop a purposeful plan for transformative innovation. Opportunities for collaboration on implementing a strategic foresight and virtual think are welcomed by the author.

Sketching at scale: the HDL Studio model

Bryan Boyer*
With contributions from Justin Cook and Marco Steinberg**

Europe is under financial duress, it's freaked out about climate change, and it's about to get a lot more gray. What to do? Set against a backdrop of the global financial crisis and slow economic growth, our governments now have to make good on promises made generations ago. How will cities, regions, and nations keep these promises when the imperative is to cut spending any way possible?

Today's challenges fall at the intersection of what we know. They have multiple owners; they are riddled with legacy issues; and they are continually evolving. While traditional models of innovation and design have focused on optimizing individual parts, we have not been able to transition our capabilities to address the "architecture of the problem." Big picture dynamics will govern our future. This is particularly acute in government contexts that are often saddled with inertia.

Governments spend billions annually on research and development in specific areas of content, such as education and defense, but they tend to invest little in developing new ways of solving problems. Yet the issues that our governments have to contend with are unique in their scale and complexity. As demographics and the climate change in the 21st century, these challenges will rewrite the assumptions we've inherited from previous eras of prosperity. How will governments organized around 18th century principles of management be able to keep up? If we hope to minimize the effect of macro trends that have the potential to create periods of intense hardship we need to develop new ways of working.

Sitra's HDL Studio model borrows the pedagogical format of the design studio and repurposes it in a professional setting as a way to develop a robust, integrated framework for understanding difficult challenges and developing a way to respond. Ultimately it's a tool that organizations themselves, and by this we're mostly interested in various levels of government, may use to co-create strategy in a hyper-accelerated manner. The studio brings together a mix of content experts and designers

* Design Lead, Strategic Design Unit. The ideas presented here have been developed through constant collaboration with Justin Cook and Marco Steinberg, my colleagues in the Strategic Design Unit. However, any clumsiness of language is my fault and mine alone.

** Sitra, The Finnish Innovation Fund. Portions of this article are based on "The Helsinki Design Lab Studio," publication forthcoming in VOLUME magazine issue on Aging, March 2011.

to work intensively for one week at the crux of problem and solution. The outcomes of the HDL Studio are a strategic framework that describes the *ecosystem of the challenge* and supports this with a list of hunches that together comprise *an architecture of solutions*. These outcomes help frame a path forward by identifying new opportunities and specifying the first steps of work necessary to take advantage of those insights.

During the summer of 2010 we conducted three studios in Helsinki, Finland looking at ageing, education, and sustainability. We use the HDL Studio model is to develop a holistic understanding of a challenge, which is the essential first step in any strategic design activity. This focus on the studio as a foresight mechanism is a reflection of the current state of Sitra's experience in applying strategic design which has so far been concentrated in early stage efforts (such as the studios we've conducted to date). As some of our initiatives come to fruition over coming years, including the Low2No Urban Development project[1], we look forward to sharing further insights that shift the focus from developing early stage foresight to stewardship by design.

This paper is presented in two parts. First, we unpack strategic design as a general way of thinking and doing that underpins the studio. This is followed by a look at the people, process, problem conceptualization, and place necessary to apply the HDL Studio model.

Mind the gap

One of design's value propositions is that it offers a way of understanding problems and solutions in a feedback loop rather than a linear relationship. Simple solutions may follow simple problems, but answers to complex questions are more likely to co-evolve with our understanding of the very issues they're attempting to address. The space in which this coevolution happens is the overlap between analysis and execution.

The dominant logic of European society in the 20th century saw analysis and execution conducted by separate parties in service to the same client, either as different departments within the same organization or completely separate entities. In extreme cases this resulted in consultants analyzing a situation and developing a brief that was then won and executed by contractors. This approach

1 The Low2No project is Sitra's first significant application of strategic design methodologies, the outcomes of which will be a 25,000 square meter complex of low carbon buildings in central Helsinki, a transitional strategy for the complex to reach carbon neutrality, and a transferable model of low carbon urban development.

works well if the problem can be clearly defined and remains static, but it fails to deliver when the problem is fuzzy or dynamic.

The gap between formulating questions and crafting answers is where the richness of the problem and the robustness of the solution are left to languish when they are not in conversation with each other. Design has always operated at the pivot between thinking and doing, and so strategic design acts as the glue between analysis and execution – reflecting each onto the other, enriching both, and offering a more holistic way to handle wicked issues.

A middle way

Our schools and universities are often divided into two distinct parts[2], one that develops the knowledge of the sciences and the other which focuses on the humanities. Taking a closer look at where departments of design and architecture physically sit within our learning institutions reveals evidence of an ongoing struggle to make sense of what design has to offer. Sometimes designers share a building with engineers, while other times they are colocated with fine arts. Only occasionally do the design departments exist on their own, separate from both the humanities and the sciences. Perhaps the difficulty is that design combines some aspects of both and therefore could legitimately be considered a Third Culture of knowledge.

We see design as a way of working and thinking that sits between the two poles of science, which searches for fact within the material world, and the humanities, which seek truth amidst the messiness of human experience. Design takes a middle path and is primarily concerned with appropriateness[3], that fragile quality which is achieved when the best of human intentions are realized within the constraints of reality. Design is a culture that blends the concerns of science and the humanities to search for outcomes that are balanced and opportunistic, grounded in the real world but driven by human aspirations. It is equally concerned with the development of creative intentions as it is with overcoming the contingencies inhibiting the realization of those intentions.

Just as being musical does not necessarily mean you are a musician, there are differences of sophistication and ability between people who are 'designerly' and those who are experienced designers. Neither musicians nor designers ply their trade without likeminded clients and therefore the understanding of someone who is designerly is a necessary complement to the ability of a

2 C. P. Snow. *The Two Cultures*. Cambridge: University Press. 1960.

3 Nigel Cross. *Designerly Ways of Knowing*. Basel: Birkhauser. 2006.

designer. For the purposes of this discussion "designer" is not meant to be defined by professional title or words written on a diploma. We think of designers as people who exhibit the attitude, approach, and abilities outlined in the following sections. Normal Bel Geddes, one of history's most influential industrial designers, says it more eloquently: "No matter what he [sic] does, in work or play, in one location or another, [a designer] thinks in terms of design. It is natural to him."[4]

Becoming strategic

From the emergence of design as object making in the 19th century to design as a way to coordinate global brands in the 20th century, each step in this evolution represents a move from design as giving shape to objects towards the shaping of decision-making. The career of vaunted designer Raymond Loewy traces this upstream movement of the use of design rather succinctly. After launching his career creating the streamlined appearance of appliances in the 1920s, Loewy rebranded the Shell Oil corporation and was eventually asked by US President John F. Kennedy to redesign that most visible manifestation of international statesmanship, the presidential jet.

Today a small but growing group of cutting-edge practitioners are going one step further by using design to peer into large scale systems and develop strategies that enable us to affect them in positive ways[5]. Strategic design is a way to specify the systemic performance that we want to achieve and steward efforts towards the accomplishment of those aims.

Design, like engineering, law, plumbing or any other category of knowledge, is a way of working. Each of the following sections take a deeper look at the attitude, approach, and abilities that enable the successful application of strategic design. The reflections in the following sections overlap with areas of organizational psychology, management, process facilitation, and foresight. The purpose of this exploration is not to pretend that design could or even should supplant these other fields, but to explore the qualitative differences that arise when choosing the middle path.

4 Norman Bel Geddes. *Horizons*. Boston: Little Brown. 1932. p. 17.

5 It is by no means a complete survey but Sitra has begun to assemble case studies of accomplishments in strategic design at *http://helsinkidesignlab.org/casestudies/*

An attitude of empathy & optimism

Culture informs a person's outlook, attitude, motivation, and commitment in ways that are often easy to recognize but difficult to describe. To add to the frustration of not being able to articulate exactly what it is, culture is also difficult to teach. Skills and procedures may be learned with practice, but developing a certain culture is a matter of cultivating it within an organization by encouraging certain individual characteristics – and this usually does not happen overnight. Yet a supportive team culture is a pre-requisite for applying strategic design, if not a fundamental aspect of 21st century citizenship. An individual's attitude is one manifestation of the culture that they share with others, and in this section we dwell on the attitude and characteristics necessary to successfully make use of strategic design.

It begins with a sense of *empathy* that makes one sensitive to the needs of others, enabling an individual to see the world through the eyes of others. Empathy feeds *inquisitiveness* and the desire to know why things work the way that do. This requires *observation* and a fundamental understanding of people, things, and decisions as *situated in time and space* and therefore connected to and influenced by their context.

Taking action informed by empathy and observation is a domain where only optimists may tread; without *optimism* that a better way is possible there is no reason to try. The grand challenges that strategic design is most applicable to are characterized by inconclusive, incomplete, or unavailable information. Being *comfortable with ambiguity* means one has to be able to *suspend disbelief* and maintain a trajectory through situations involving doubt, and inevitably risk.

The combined effect of these traits is to enable balanced judgment in selecting relevant problems and pursuing viable solutions. By developing a team culture that fosters these characteristics, one creates an environment that has the ability to nurture a design process. It's OK if every individual does not meet all of these criteria, and you would have a dream team if they did, but everyone does need to share a common goal. The ability of each member to work in a team, and their commitment to doing do so earnestly, is non-negotiable. Without a culture of teamwork and an attitude that is practically able to take advantage of collaboration, positive overlaps of skillset, worldview, expertise are stifled. And it is precisely those overlaps which help innovation flourish.[6]

6 Steven Johnson. *Where Good Ideas Come From*. New York: Penguin. 2010.

The pursuit of synthesis

> *"A decision cannot be fairly characterized as 'strategic' unless it is a conscious choice between two legitimate and rational alternatives. It must be borne of deliberation and not happenstance, inattention or neglect"*
> *– US Supreme Court Justice John Paul Stevens*

In the spring of 2009 Sitra launched the Low2No Urban Design and Development competition which invited teams to propose a vision for a low carbon complex of buildings to be built near the center of Helsinki. Unlike typical architecture competitions, however, the teams taking part in Low2No were asked to pay particular attention to the expertise profile represented by their teams. The winners would create an ambitious proposal combining a strong architectural vision with strategies for the financial and infrastructural models that would make their vision achievable. By supplementing the typical competition requirements with the request for a holistic vision, Sita forced the Low2No competitors to assemble integrated teams that could intelligently respond to the brief. In effect, Sitra used the rules of the competition to encourage the formation of new alliances that could fill in the existing gaps in the market where there are few firms that are single handedly able to address the holistic nature of the climate challenge. New problems demand new solutions, and in the case of Low2No that also meant synthesizing new teams.

Strategic design uses an approach of synthetic integration to create new possibilities when deliberation between existing options proves unsatisfactory. When using strategic design, analysis is not the platform on which decisions are made, but becomes a step used to inform the design of novel options. As a capability that enhances innovation, it is therefore most useful in contexts where typical decision-making practices have proven ineffective at meeting the demands of the challenge at hand.

Synthesis is also at the heart of the familiar process of evolution. Mother nature has the luxury of being able to wait millions of years for the combinatorial randomness of evolution to slowly march towards viable species and useful inventions. Humans, on the other hand, have to invent ways to speed up the creation of good ideas without waiting around for random chance. The diversity of a gene pool and the ability of its individuals to successfully procreate shapes the viability of that genetic lineage. Creating synthesis in strategic design activities also requires a diversity of inputs and the ability to combine and recombine them until strong ideas emerge.

The strategic design approach entails three facets: an open-mindedness that looks for insights in atypical places without favoring hard facts over soft evidence; a non-linear way of working which involves cycling between refining the understanding of the problem and searching for solutions; and a concept of targeted focus that directs effort to the key moments in a project's development, thereby enabling the strategic designer to coordinate critical scales so that they work in harmony.

Daring to ask dumb questions

Synthesis relies on having options to choose from so that the best of each may be cherry picked to create something new, and the more options the better. Mother Nature's way of thinking generating distinct options is the genetic mutation. By subjecting every living thing to small mutations, Mother Nature proves her patient ability to wait for the cumulative effects of many generations of combined mutation to eventually manifest themselves as recognizable but unexpected differences between species. As humans we have to be impatient and must develop ways to break out of the mold of the expected. Being diligently open-minded is a way to cultivate innovative ideas.

Maintaining a skepticism of the givens is a powerful way to remain open to new possibilities. The strategic designer assumes that they don't know the full story and that something or probably many things are missing from the picture. Seeking a diversity of new and different inputs helps complement whatever knowledge exists in a given area and contributes to the formation of a better big picture.

The available information may be broadened by looking to new sources such as searching for analogous cases where experience may be transferred from another professional domain (what?), culture (who?), or geographic context (where?). History often provides examples of previous attempts (when?) to solve similar or related issues, even if the exact problem is now being phrased differently. Regardless of the source, analyzing qualitative differences (how?) is a way of interrogating the relationship between an idea and its context to understand the critical factors which might affect its transferability to a new context.

These basic questions of who, what, when, where, and how are supplemented by introducing the notion of scale. Being conscious of scale enables the strategic designer to test concepts by thinking about their impact at or relevance to different scales. Information that is critical to frontline stakeholders might be invisible to national decision-makers for instance, so using scalar thinking

is a way to be skeptical of a situation, see it through the eyes of others, and target your inquiry to uncover the relationships between big and small. The goal in pursuing these various lines of questioning is to cast the net as wide as possible and gather the broadest set of inputs to create a diverse 'gene pool' for synthesis.

Working in loops, not lines

> *"Secrets, at least theoretically, can be obtained in one way or another... Mysteries, on the other hand, are unknown or unexplained phenomena... It's futile to try to steal the answers to these questions."*
> *– John C. Gannon, Deputy Director for Intelligence, US Central Intelligence Agency*

Working cyclically rather than linearly means focusing on the details and the relationships between them at the same time. In this sense, the working approach of strategic design is akin to setting out to bake a great cake, without ever having made one, not knowing a recipe, and not having any idea which ingredients you have in your kitchen.

Only by digging around in the pantry do you begin to discover useful ingredients, and through testing and speculation you begin to develop a sense of how your ingredients might work together in a recipe that results in something vaguely cake-like. Once you've baked your first few cakes you begin to understand the nuances of the recipe and the importance of certain ingredients in proportion to each other. You might adjust the amount of flour for a denser texture or perhaps you splurge for locally grown organic cherries because you know their tart flavor will really sing with some chocolate. The exact specifics of your solution evolve as you perfect the recipe and begin to understand which ingredients are really key. By hunting and gathering ideas, trial and error of concept, and the careful calibration of relationships you've found the recipe for an excellent cake.

We call this process sketching. The Seductive beauty of wispy lines drawn by talented designers often gets the attention, but at its core sketching is a way to develop relationships and details in parallel. Traditionally sketching is used to begin a design process by allowing the designer to explore different formal ideas in a quick and free-flowing way. The power of the sketch comes from the fact that it implicates an idea without requiring that every tiny detail be specified. A sketch's written equivalent is the bullet-point outline, but whereas an outline can only makes sense when read from top to bottom a sketch is more open to interpretation and can be read in many different ways.

This allows the momentary suspension of disbelief, offering the freedom to fluidly move between developing the overall idea, the essential elements, and the relationships between them. A good sketch of a human figure captures the dynamic form of the body in broad strokes while also showing select details of the musculature at key moments. By depicting aspects at a number of different scales, the act of sketching out an idea is a way to identify what matters most and what can be addressed later on.

Young designers spend days at a time sketching and re-sketching the same figures and still life compositions as a way of developing a sensitivity to scale and proportion – two ways of being specific about relativity. Putting the initial emphasis on relations rather than objects allows the designer to quickly test new configurations by sketching them out. Strategic design rarely lends itself to such literal translation onto the page, but we can still sketch through problems by giving ourselves the same freedom to identify key elements and then work between scales in a nonlinear way.

On a conceptual level, let's zoom out for a moment and look at another nonlinear relationship: the way that problems connect to solutions. The words "problem" and "solution" have come to be used in a way that implies a one-to-one relationship between the two. For every problem there is a best solution, and likewise every solution is designed for a single clear problem. This is an exaggeration, of course, and the designers of the Swiss Army knife might take offense at our characterization, but in broad strokes the relationship described here has driven the pursuit of new knowledge in the 20th century, such as the basic division between science and the humanities reinforced by so many schools.

The drive towards specialization that accelerated with the Industrial Revolution continues to encourage increasingly narrow definitions of problems and solutions by constructing disciplinary silos that effectively "own" groups of problems. This protects the silos from outsiders as specific jargon, practices, and attitudes naturally evolve within the discipline, further reinforcing the strength of the silo, and creating a barrier to entry.

The combined result of this mass specialization is akin to rendering an image in the pointillist style where dots are used in place of continuous brush strokes. From afar the pointillist painting is legible as a singular image, but step closer and you see the image is made from thousands of dots of paint with many gaps between them. While the dots tend to be quite regular in size and shape, the negative space of the gaps between them often take on irregular shapes. The deep specializations of contemporary society have allowed us to think that we are seeing the big picture, when in fact our knowledge is represented by thousands of isolated dots – silos of knowledge – with plenty of gaps in between.

If we extend the metaphor to include time and imagine the development of specializations in our universities, governments, and other organizations, it's as if the dots of the painting are growing increasingly small as they focus deeper and deeper on specific concerns. Adding more dots to maintain the quality of the image only creates... more gaps!

While we've become better at defining and tackling issues within the 'dots,' the gaps between them – those spaces between deep silos of expertise – are where the challenges of the 21st century lay. We are barely able to name this area without resorting to metaphors[7], let alone describe the territory richly or deliver replicable results on the challenges that lurk there. To address a different kind of challenge one needs a different kind of approach. This is why strategic design posits that problems and solutions cannot be understood in their traditional 1:1 linear relationship.

Part of the complexity of our most challenging issues stems from the fact that we don't even have the ability to fully describe the challenge. The linear approach of first fully defining a problem and then crafting a solution proves futile in situations where the problem is illdefined and is likely to remain so due to lack of consensus or a dynamic context. This is the difference between secrets, those things that we know we don't know, and mysteries. Secrets can be uncovered definitively but the full understanding of a mystery remains forever out of reach.

When working in mysterious territory, we gently reject the assumption that problems and solutions can be well defined as separate elements with a linear relationship. We prefer to describe problems and solutions as existing in a continuous feedback loop where a piecemeal increase in our understanding of the problem enables better ideas towards its resolution. The hunch of a solution inspires new questions about the problem space and that is where the cycle begins again. The picture, as it were, is formed by seeing the dots, the gaps, and the overall relationships between the two in the same way that the human brain senses and makes sense of both simultaneously.

This cyclical way of working means radically rethinking the way that problems are approached. For one, it means being unafraid of diving into challenges that seem murky. Is it too much of a provocation to acknowledge that the best way to understand a problem is to set about trying to solve it? The evidence of humanity's slowly accumulating progress on the climate challenge points to the necessity of cyclical problem/solution approaches that reconceptualize problems based on attempted solutions. Failures to meet the demands of this challenge, particularly in the context of the built environment, also point to the converse proposition: that the best way to develop robust solutions is to understand the root causes of the problem. Whether trying to define a problem or

7 Rittel & Webber have their "wicked problems," Nassim Taleb is haunted by "Black Swans," and the list goes on.

develop solutions, true innovation requires a cyclical approach that flips between these different modes, improving with each cycle.

This is how our understanding of problems and solutions co-evolve towards an imagined point of convergence where the problem is perfectly defined and the solution perfectly appropriate. Within grand challenges perfect convergence between problem and solution is unlikely to ever happen, so developing a comfort for this asymptotic approach is an important quality if one hopes to work in this area. We cannot think of a truer definition of optimism.

Relevance = value + communication

Strategic designers are particularly concerned with transitional points, because these hand-over moments are where the hard-fought richness of synthesis is most susceptible to being lost. This means paying extra attention to the formatting and communication of outcomes, because impact is seriously limited when content cannot be successfully communicated. This is especially true for the holistic models that strategic design tends to create because their execution always requires collaboration, which is built upon common understanding. It also entails being realistic about what can be handed off and carried out by someone else independently, what should be done together, and what requires occasional involvement or stewardship on the difficult road from implementation to achievement.

In the past, printed reports have been the dominant tools for sharing strategy, but what good is a report that no one reads? For a number of reasons, these reports seem almost mandatory – or may even be legally mandated, depending on your organization's status. Yet, after spending so much time and effort to craft a strong, synthetic strategy it doesn't make sense to assume that traditional communication materials are the best way to share it.

At the early stage of Helsinki Design Lab we took a different path, which was to focus on conversations as our primary format for transferring the knowledge developed during the studios. This forced the studio teams to articulate their message in a very digestible way that could focus short but intense discussions. With the key messages communicated to our essential stakeholders through the 'final review', we then turned to video as a compelling way to expand the conversation to a broader audience in a format that is attractive and accessible enough to develop its own trajectory across the web. Only after these efforts are we now turning our attention to the written report which will be useful as a continual touch point during the evolution of Sitra's work on the topics of ageing, education, and sustainability.

Core competencies of the strategic designer

The attitude and approach of strategic design define a certain mindset that's needed to succeed with this way of working, and there is also a necessary skill set. These skills span from those which are straightforward, such as the ability to sketch, to others which are harder to pinpoint, such as the ability to be able to translate between different professional cultures. This section is not an exhaustive list, but provides an overview of the core competencies of the strategic designer which fall into three categories: the ability to work as an integrator, an aptitude to use visualization to ask new questions and develop a different kind of consensus, and a stewardship capacity that can meaningfully contribute to the overall development of a project.

The naturally tendency of design to work towards *integration* and synthesis is important because it illuminates the complex web of relationships – between people, organizations, and things – that are necessary to form a holistic point of view. Developing a synthesis requires new ways of conceiving of problems and solutions in an integrated manner.

Today, the challenges we face have reached a new level of complexity and uncertainty for which spreadsheets and other familiar analytical tools are insufficient. To see challenges in a new light we sometimes do have to literally see them differently. This is why *visualization* is more effective when it's used as part of the thinking process, rather applied after the fact to pretty-up ideas that are fully formed. Fluent in visual representation, the strategic designer uses this skill as a means of communicating complex, even contradictory, relationships which would be difficult or impossible to explain in text and numbers alone.

Successful design is not only about creative thinking. It also involves converting ideas into actions, which is the role of *stewardship*. Strategic designers must be able to contribute over the duration of a change process, providing regular feedback to identify, test, and deliver durable solutions. Good ideas are relatively easy to come by, but implementing the right ones is not.

The HDL Studio model

To make this rich relationship between problem and solution accessible and operative, Sitra is developing the HDL Studio model as a tool to kickstart work within a thematic area of concern. Successfully using the studio as a way to apply strategic design requires the right people, a flexible process, a carefully defined problem, and a place that is conducive to collaboration. Provided below is a sketch of what this looks like. Sitra will publish a more comprehensive studio manual this fall.

Studio people

We keep the studio team small so that the outcomes can reflect a single conversation. Each studio consists of a team of eight people, two of which are designers, and the rest of which come from diverse backgrounds relevant to the topic. Each studio roster is developed by searching for top talents who were willing and able to work in collaborative environments. It's a pairing that does not always come easily, but without the ability to work collaboratively expertise is useless in a studio. The group should be diverse in age, gender, and geography as well as professional domain.

Our Ageing Studio included a health econometricist, a psychiatrist whose focus is on death and dying, a public sector management researcher who has spent a lot of time looking into acute crisis response methods, someone with a background in product development for individuals with diverse needs, the head of the Innovation division in Finland's Ministry of Employment and Economy, a junior designer whose private practice is highly strategic, and a design lead whose bread and butter is assisting various organizations in the UK transform themselves through design.

In addition to the studio team, the stakeholders who will receive the outcomes of the studio are also important. Cultivating this audience so that they are receptive to strategic thinking is essential. We selected for open minded 'owners' of problems – the people who have a burning need to look for new ways of doing – and attempted to involve a range of people from city, national, and EU government as well as non-profits and NGOs.

Studio process

In our usage "process" implies a general way of working rather than a rigid set ofsteps to be followed. In broad strokes the HDL Studio model is designed around an intense five day engagement with longer periods of support and preparation on either side of the week. While the team is on the ground the emphasis is on building up enough of an understanding of the problem at enough different scales that these inputs can be combined with the experience of the team to yield a synthesis that reframes the challenge and proposes a series of 10 hunches for how to start working towards its resolution, both of which are the deliverables for the week.

The first two days are focused on understanding the issue, the final day is spent in discussion with an invited group of stakeholders, and the middle of the week is left for the studio to use at their discretion. Studio assistants are available to help pursue research questions as they arise or to arrange visits if necessary.

In a practical sense this means that Monday is consumed by lectures and Tuesday is spent in the field, so everything happens at an accelerated pace. Our ageing studio heard speakers who addressed macro-level topics and took trips to experience the micro-level first hand. They visited the city planning department in Jyväskylä which is exploring an integrated approach to planning decisions, took a tour of an elderly residential and care facility, and had a chat with the city officials who oversee health and social services.

Because of the compressed schedule, dinners and lunches become important opportunities to downshift into a more casual mode that allows work to continue in a social context, layering on new opportunities for consideration as well as offering the team the chance to get to know each other better.

Studio problem

We believe that good design begins with a great brief. Picking the right problem for a design studio can be tricky because the best ones exist in a middle ground between specificity and abstraction where the challenge is big enough to be important, but specific enough to be workable. We handle this by selecting a general theme and layering it with a specific challenge, which together are delivered in a document called a Challenge Briefing.

Before the studio members got on a plane or train to come to Helsinki we sent them a slim 30 page Challenge Briefing that introduced the challenge and provided basic facts covering 5–7 key 'dimensions' specific to the studio. Since the studio members approach the week from different angles with no previous experience working together, this document is intended to act as a common starting point for all. It's part history lesson and part provocation.

The theme of the Ageing studio was demographic change on a macro level, but we asked them to specifically consider how to rethink welfare and the Finnish welfare system. The result was a challenge briefing entitled "Extending Well-Being: Rethinking welfare for an ageing society" with the key dimensions being Baby Boomer Demographics, a survey of the offerings of the current day welfare system in Finland, the development and history of the Finnish welfare system, indicators of wellbeing, and recent regional innovations in the Finnish system.

Studio place

Working collaboratively in an integrated way does not always come easily and working long hours can be emotionally and physically draining. For these reasons, the environment of the studio is important. Getting this right creates an atmosphere of hospitality that enables the studio team to worry about the quality of their work and their deliverables instead of being bothered by the lack of creature comforts or missing tools.

For the HDL Studios in 2010 we rented an airy space in central Helsinki with big windows, a large table, lots of whiteboard space, and a café nearby for quick breaks. We used the studio as a multi purpose space to host the usual brainstorming sessions and lectures, as well as dinners and vernissage parties that served as opportunities to introduce broader groups of stakeholders to the content of the studios as we simultaneously illustrated what strategic design looks like in a tangible way.

Sketching at scale

The HDL Studio is a shortcut to sketching ways of handling complex problems. The value of the sketch is rooted in the ability to quickly organize and communicate intent even when the details are still unclear or in flux. To assist government in developing the agility it will need to make inroads on wicked challenges, Sitra is developing the HDL Studio model as a way to make the notion of strategic sketching something that is tangible and practicable.

Given the difficulties that many government institutions now face as budgets are tightened, we are interested in what happens when these bodies develop new capabilities to see the big picture and target their efforts to deliver value in response to root causes. What happens when governments work iteratively, balancing hard evidence against softer cultural and behavioral factors, and take advantage of integrated knowledge? In other words, what happens when government bodies are naturally able to design?

For further information please see our websites:
www.sitra.fi/en
www.helsinkidesignlab.org

Foresight in the local context

Richard Silberglitt *

This paper describes the essential elements of a communication approach and style focused on addressing the interests and needs of key clients and stakeholders of technology-oriented foresight. These interests and needs are incorporated in a concept that we define as the "local context." Here "local" does not signify geography, but rather the environment in which the clients and stakeholders live. Thus the term "local context," as used in this paper, encompasses the social, economic, political, institutional, and cultural situation that technologies evaluated by the foresight will face if the clients and stakeholders choose to apply these technologies to address the problems and issues that are important to them. We note that, according to this definition, the local context is not static, but changes over time, and so, to be an effective input to decision-making, foresight must always state the timeframe that it is intended to address.

We propose that foresight in the local context contains the following three fundamental features:

- Technologies described in terms of their potential application to provide some needed function for a user. Hence in the following our focus is not simply on trends in technology developments, but rather on the *Technology Applications* (TAs) that are derived from them. For example, cheap solar energy rather than the nanoscale photovoltaic systems that enable this TA through reduction in the amount of material needed and the ability to use manufacturing methods that can be scaled to mass production.
- The *drivers* that may support the widespread sustainable implementation of the TA, as well as the *barriers* that may prevent it. These drivers and barriers can span the entire range of societal areas and issues relevant to the clients and stakeholders. For example, they may include such diverse areas as availability of capital, public opinion, levels of education and training, quality of governance, and viability of necessary institutions and infrastructures.
- The *capacity* that is available, or may be obtained, to support the implementation of the TA. This consists of the human capital, physical infrastructure, and government and institutional systems currently in place or that can be put in place in the

* RAND Corporation, USA: Mailing address: 1200 South Hayes Street, Arlington, VA 22202-5050, USA; email address: *richard@rand.org*.

timeframe addressed by the foresight. For example, the TA used as an example above, cheap solar energy, requires little capacity, while TAs such as tissue engineering or quantum cryptography require sophisticated scientific and engineering training and infrastructure, as well as relevant markets and institutions to deal with issues such as public health, safety, and security.

We use examples from the foresight literature to illustrate how these three features are used to support effective communication of foresight results to clients and stakeholders. The examples include local (in the geographic sense), national, regional, and global clients and stakeholders.

Japan's National Institute of Science and Technology Policy (Nistep)

Nistep addresses the Japanese "local context" by focusing its foresight work on providing input on science and technology developments to support decision-making for Japan's Science and Technology Basic Plan and to allow evaluation of alternative science and technology policies aimed at addressing social issues of importance to Japan such as its declining birthrate and aging population and global warming.[1] This has resulted in identification of TAs such as home-helper robots and information and communication systems that allow personal medical data to be transmitted to doctors in real time. The potential impact of these TAs is conveyed to clients and stakeholders, in this case relevant government ministries and the Japanese public, through a set of scenarios that show how technology developments can enable each of these TAs and how increasingly more sophisticated versions could be used by Japanese citizens over time. This is illustrated for the thrust of healthy aging through the use of commercial products, from those currently available such as robotic vacuum cleaners, to emerging products such as robotic pets and wearable heart monitors, to future products such as video links for direct monitoring of patients in their homes and humanoid robots to provide continuous care 24 hours a day, 7 days a week. The scenarios are coupled to research and development needs over specific timeframes that could make the TAs described in the scenarios a reality. Relevant social issues are brought into the analysis of Japan's grand challenges in science and technology policy that must be addressed to develop the capacity that Japan will need to achieve the envisioned futures. For example, a Nistep report on the capability of local regions for green innovation explores the local capacity for sustainable development in Japan and the science and technology initiatives that will support such development. Tying together the issues of national importance with detailed, clearly illustrated scenarios that show how the TAs in the foresight serve the future needs of Japanese citizens and how the Science and Technology Basic Plan can support the development of these TAs provides

1 See the NISTEP Director General's message at *http://www.nistep.go.jp/index-e.html* (last accessed on November 21, 2010).

a communication style that at once appeals to both government and private sector decision-makers and the Japanese public.[2]

The Apec Center for Technology Foresight (Apec CTF)

Apec CTF was established in 1998 as a project of APEC's Industrial Science and Technology Working Group (ISTWG), hosted in Bangkok by Thailand's National Science and Technology Development Agency (NSTDA). The Thai government provides Apec CTF's core funding, with special APEC-wide foresight projects involving cooperation with multiple Apec economies funded on an individual basis by ISTWG. Apec CTF, which is currently (since 2009) hosted by the Thai National Science Technology and Innovation Policy Office (STI), performs regional, sectoral, organizational, and Apec-wide foresights, as well as providing training in foresight methods aimed at developing and diffusing foresight capabilities to Apec economies.[3] Over the past decade, the Center has carried out foresights that encompass a broad range of problems and issues of importance to the Asia-Pacific region and the Apec member economies, for example future fuels, megacities, water supply and management, sustainable transport. We highlight in this paper two recent Apec CTF foresights: converging technologies to combat emerging infectious diseases (EIDs), and low carbon futures for the Asia-Pacific region.

In the former case, the local context was the developing trends in the emergence or re-emergence of infectious diseases, for example, malaria, novel strains of influenza, dengue fever, and the challenges in identifying, tracking, monitoring, and treating infected individuals, as well as designing and implementing early detection and mitigation measures to prevent or lessen the effect of pandemics. PEC CTF characterized this local context through an extensive literature review and bibliometric analysis and an on-line survey of experts across the Asia-Pacific region that identified key challenges and impacts on these of potential TAs in public health surveillance, earth and climate observation, and detection, diagnosis, and identification of diseases. By involving experts throughout the region at this early stage, the Center was able to incorporate the issues and perspectives of its different societies, thus laying the groundwork for communicating the eventual results to a diverse set of stakeholders.

---

2 A briefing that shows how NISTEP combines a Delphi survey with scenario writing and analysis of regional capacity for innovation is available at the above URL under NISTEP REPORT No. 142 (Abstract of the 9th Science and Technology Foresight, pdf file last accessed on November 21, 2010).

3 For details concerning the history, activities, and publications of APEC CTF, see its website at *http://www.apecforesight.org* (last accessed on November 21, 2010).

This foresight was then executed via three workshops. The first workshop developed scenarios that envisioned outbreaks of EIDs and considered possible outcomes 10 years in the future based on the availability, or lack thereof, of specific TAs, and possibilities for their successful use based on both technical developments and the social, economic, political, and cultural environment that might provide drivers or barriers. This led to the identification of technology domains and TAs within those domains that were the focus of two technology roadmapping workshops. The resulting technology roadmaps highlight the necessary capacity development, the challenges and barriers, and technology strategies for specific TAs with significant potential to combat EIDs over the near-, mid-, and long-term. Apec CTF employed two approaches to facilitating communication of their results to clients and stakeholders. The first was organizing the foresight activities and findings around a simple framework that captures the lifecycle of an EID. This EID lifecycle model, illustrated in Figure 1 with some examples of TAs to combat EIDs, provided a common basis for discussions and a means to integrate the recommendations of the technology roadmaps. The second communication approach was to hold a final symposium at which the foresight results were presented, discussed, and reviewed by a diverse group that included clients and stakeholders. Apec CTF has used this communication approach successfully on many occasions. It provides the opportunity to showcase foresight results to clients and stakeholders in a venue in which the depth and validity of the analysis can be demonstrated and discussed, with presentations at a level that do not require technical or foresight expertise.

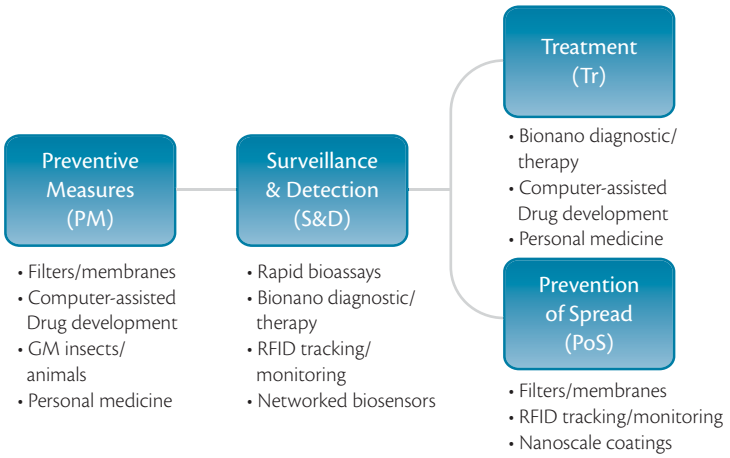


Figure 1 - Emerging Infectious Disease (EID) lifecycle model

The second Apec CTF project we wish to highlight is its most recent foresight,[4] which examined possible low-carbon futures for the Asia-Pacific region and, through scenarios, backcasting, and a technology foresight symposium, identified policy, technical, institutional, and cooperative initiatives that may be undertaken now to address the challenges foreseen over the next 40 years due to climate change. Apec CTF characterized the local context with a real-time Delphi survey of 78 experts from Africa, the Americas, Asia, Europe, and Oceania. This Delphi survey provided expert opinion, including important areas of consensus and non-consensus, on climate change and its potential impacts between now and 2050, and possible developments in areas such as migration patterns, natural resources, urban and rural societies, public and individual health, trade of goods and services, and housing and transportation. This led to a chronology of societal, technical, and policy developments by decade to 2050 that formed the principal input for a scenario workshop. The breadth and diversity of Delphi experts and scenario workshop participants, including climate scientists, government and private sector leaders, engineers, economists, and educators, contributed to a rich texture of envisioned 2050 low-carbon futures, as well as the societal and technical challenges that must be addressed if any of those futures were to be realized.

This project was concluded in January 2010 with a technology foresight symposium at which detailed aspects of low-carbon futures in areas such as urban and rural lifestyles, use of energy and other resources, infrastructure, governance, education, and economic development were discussed, leading to a final report with specific recommendations at both the national and regional levels for Apec economies to begin to lay the groundwork for a transition to a low-carbon future. These recommendations are explicitly based on the substantial differences between a "business as usual" future resulting from the continuation of current policies and trends and the 2050 low-carbon futures envisioned in the scenarios. Communication of the foresight results to clients and stakeholders was facilitated by a pyramid approach – Executive Summary featuring the policy recommendations and outlining their basis, Final Report summarizing and integrating the results of the Delphi and scenario efforts, and detailed Delphi and scenario reports. The impact of the entire project is enhanced by the presentation of the results in a recyclable cardboard package containing the Executive Summary printed on recycled paper and the full results, including all of the reports, on a reusable wooden thumb drive.

4 This foresight, in which 15 APEC economies participated, was funded by Thailand's Ministry of Foreign Affairs. The results can be viewed at *http://www.lcs2050.com* (last accessed on November 21, 2010).

The Millennium Project

The Millennium Project was founded in 1996 as a result of a feasibility study conducted for the United Nations (UN) University. It is currently an independent non-profit organization with a global network that has been performing global futures research for 14 years and publishes an annual *State of the Future* report.[5] This provides a parallel approach to that of the UN Development Program, which tracks the UN's Millennium Development Goals, a set of targets aimed at reducing extreme poverty with a stated deadline of 2015 that were adopted by world leaders at the Millennium Summit in September 2000.[6] Both of these organizations focus on a "local context" that is explicitly targeted toward human development, with a global reach. They both do an excellent job of communicating their findings in straightforward, easily understood language and back up their conclusions with data on globally recognized indicators. However, The Millennium Project is most relevant to this manuscript because of its ongoing foresight work. More specifically, its most recent foresight study[7] very carefully and explicitly characterizes and evaluates global human development indices and describes the future in terms of areas in which the world is improving ("Where we are winning") and areas in which it is getting worse ("Where we are losing"), as well as noting areas in which there is little change and those in which there is uncertainty. For example, access to water, poverty rate, GDP per capita, life expectancy at birth, and number of deaths in armed conflict are some of the areas showing improvement, while CO2 emissions, unemployment, levels of corruption, and refugee populations are some of the areas getting worse. Examples of areas showing little change include prevalence of HIV and homicide rate, and examples of areas in which there is uncertainty are forests as a percent of land area and number of EIDs.

The *State of the Future* reports address all three of the aspects of foresight that, in our view, characterize foresight in the "local context." In their analysis of technological developments, they explicitly consider how technologies can be applied to address human development problems, e.g., to improve access to water or to reduce CO2 emissions. They explicitly discuss the global societal factors and environment that govern the challenges to implementation of technology applications and the drivers and barriers that result from them. They explicitly identify needed capacity development through a State of the Future Index (SOFI) derived from the analysis described above. The Millennium Project's communication style is aimed at both decision-makers and the general public and incorporates the views of a wide spectrum of stakeholders through the use of its global network. For example, 15 Global

5 For a description of The Millennium Project activities, see *http://www.millennium-project.org* (last accessed on November 26, 2010).

6 For a description of the MDGs, see *http://www.unmillenniumproject.org/* (last accessed on November 26, 2010).

7 Jerome C. Glenn, Theodore J. Gordon, and Elizabeth Florescu, *2010 State of the Future*, The Millennium Project, Washington, DC (2010), see *http://www.millennium-project.org/millennium/2010SOF.html* (last accessed on November 26, 2010).

Challenges are updated and published annually in the *State of the Future* report, and the process of reviewing and updating the status of each of these is continuous, including feedback from ongoing research, expert reviews, public input solicited on-line, "Node Chairs" of the Project's global network, the Project's email lists, and participation in meetings worldwide.

Another effective means for incorporating stakeholders' inputs and communicating foresight results to decision-makers is a real-time Delphi survey, which was also used by the APEC CTF in its low carbon futures study, as discussed above. The Chairs of the Millennium Project Nodes in Latin America used this method with 552 individuals to assess likely developments and impacts in Latin America over the next 20 years and identified threats and opportunities that Latin American leaders will likely face over this time frame.[8] The results of this real-time Delphi survey provided a means to surface key problems and issues within the local context of Latin America in a form that is accessible simultaneously for public debate and for consideration by decision-makers.

The RAND Corporation

The RAND Corporation, established in 1948 and headquartered in Santa Monica, California, USA, is a non-profit institution that helps improve policy and decision-making through research and analysis. Over the past decade, it has engaged in a series of technology foresight studies, leading to the publication of *The Global Technology Revolution* series of reports in 2001, 2006, and 2009.[9] The 2001 report set the stage by identifying global cross-disciplinary trends in biotechnology, nanotechnology, materials science, materials engineering, and manufacturing, as well as their synergies with information technology. The 2006 reports updated these trends, used them to define 60 emerging TAs in the 2020 timeframe, and ranked these according to their potential to produce commercial products, be used widely, and impact multiple sectors of society. The authors of the 2006 reports then assessed the capacity of 29 representative countries around the world to adopt and implement the "top 16" TAs[10], taking into account the drivers and barriers that would influence attempts at widespread

8 A brief summary of the results can be found in the Executive Summary of *2010 State of the Future*, p, 8, available on-line at the URL above. The full results are presented in Chapter 5 of the report.

9 MR-1307 (2001), MG-475 (2006), TR-303 (2006), MG-776 (2009), TR-649 (in English) (2009), TR-649.1 (in Chinese) (2009), RAND Corporation, Santa Monica, CA, USA, available on-line at *www.rand.org/pubs*.

10 These were the 16 highest ranked of the 2020 TAs, and represented a diverse "market basket," e.g., cheap solar energy, rural wireless communication, genetically modified crops, rapid bioassays, filters and catalysts for water purification, green manufacturing, tissue engineering, quantum cryptography.

implementation differently in different regions and countries.[11] Here the "local context" was the 2020 environment in each of the 29 representative countries assessed, and the results were communicated through tables and figures that illustrated whether or not each country had the science and technology (S&T) capacity needed to adopt each of the 16 TAs, as well as the presence or absence of the drivers for and barriers to widespread sustainable implementation of the TA in that country. Figure 2, reproduced from MG-475, summarizes these results in a graph that illustrates how the S&T capacity of each country, combined with its drivers and barriers, leads to its relative ability to make use of these 2020 TAs. The country groupings and their relative positions both within and between groupings, as well as the research and analysis that led to their development, have formed the basis for many useful discussions among stakeholders and decision-makers since the publication of this report. We note, however, that the country positions on this graph represent a baseline S&T capacity averaged over these specific 16 TAs. They do not indicate countries' technology development priorities or provide foresight on the development of a specific TA that might be prioritized and implemented by any particular country.

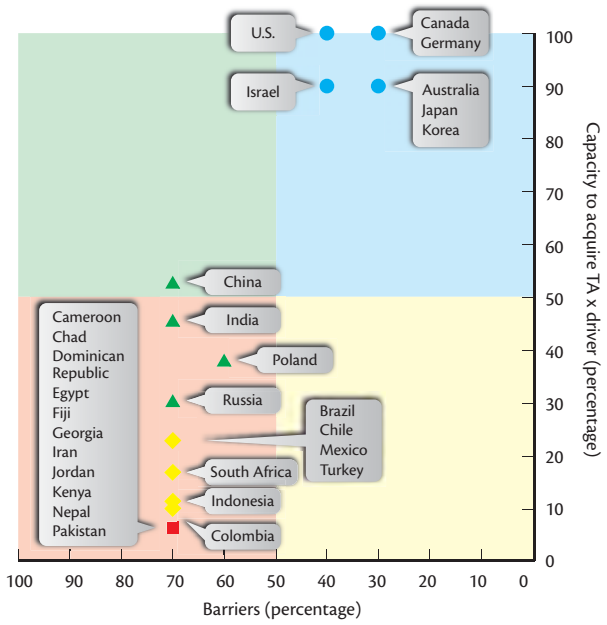


Figure 2 - Selected countries capacity to implement 16 TAs (reproduced from RAND MG-475, p. 11)

11 Drivers and barriers were grouped into the following categories: cost and financing; laws and policies; social values, public opinion, and politics; infrastructure; privacy concerns; resources and environment; R&D investment; education and literacy; population and demographics; governance and stability.

The blue quadrant indicates a high level of S&T capacity plus many drivers and few barriers; the green quadrant indicates a high level of S&T capacity with many drivers and many barriers; the yellow quadrant indicates the lack of a high level of S&T capacity plus few drivers and few barriers; the red quadrant indicates the lack of a high level of S&T capacity with more barriers than drivers. The colors of the country boxes represent level of S&T capacity measured by the fraction of the 16 TAs the country has the capacity to adopt, with S&T capacity increasing from red to yellow to green to blue.

The examples presented so far in this manuscript have illustrated foresights in which the "local context" was regional, national, or global. In RAND's most recent foresight, the "local context" was truly local, that of two development areas near the municipality of Tianjin in northeast China – the Tianjin Binhai New Area (TBNA) and the Tianjin Economic-Technological Development Area (TEDA). TBNA was designated in 2006 by China's State Council as a "special pilot zone" with a mandate to become China's next regional engine for economic growth. TEDA is its manufacturing center, with more than 100 Fortune 500 companies present or invested and over $10 billion of annual GDP. Consequently, the objective of RAND's foresight study was to identify those TAs that provide the best opportunity for TBNA and TEDA to enhance their economic development through technological innovation.

The project team built its foresight on the results of the 2006 reports described above, beginning with the top-ranked TAs which China had been judged to have sufficient S&T capacity to adopt and eliminating those that did not suit the local conditions (i.e., China's national needs, TBNA's mission, local drivers and barriers, and the capacity available to TBNA and TEDA). This resulted in the following seven TAs,[12] identified as most promising for TBNA and TEDA to pursue:

- Cheap solar energy;
- Advanced mobile communications and radio-frequency identification;
- Rapid bioassays;
- Membranes, filters, and catalysts for water purification;
- Molecular-scale drug design, development, and delivery;
- Electric and hybrid vehicles; and
- Green manufacturing.

The authors of the 2009 reports updated the foresights for each of these TAs and then developed action plans for their implementation by TBNA and TEDA based on their analysis of local capacity and taking into account the drivers and barriers to technological innovation in China and specifically

12 Detailed definitions of these TAs are presented in MG-776, TR-649, and TR-649.1.

in TBNA and TEDA. The stage of development globally of each TA and the drivers, barriers, and local capacity showed significant variation, and consequently the seven action plans differed considerably from each other. However, the reports recommended integrating them into an overarching strategic plan with three aspects: developing state-of-the-art R&D capacity in selected areas; updating and expanding the existing manufacturing base; and building capacity for S&T commercialization that will position TBNA and TEDA to compete in the global marketplace.

The foresights, action plans, and overarching strategic plan were communicated through tailored briefings for TBNA and TEDA executives, mid-level managers, and technical staff that explicitly described why each TA was appropriate within their local context, the recommended strategy to pursue that TA, the recommended steps of its action plan, and, finally, integration into the strategic plan. The length and technical content of the briefings varied based on the audience, with documentation placed in backup slides as necessary. This communication approach, focused on the local context of the foresight, captured the attention of the client (TBNA and TEDA's executive management) as well as stakeholders that included government and business managers and researchers in academia, government laboratories, and businesses. An additional means of increasing communication was a workshop held in TEDA during the project, which brought together local and regional leaders and showcased research and development initiatives, products, and marketing.

Foresight as an iterative process

As illustrated schematically in Figure 3, foresight is an iterative process, beginning with the identification of the problems and issues that best characterize the environment and interests of the clients, e.g., what they are seeking to learn from the foresight and how they might use its results. The role of foresight is to identify and characterize the TAs that can address these problems and issues, the drivers that can enhance the chances of success, and the barriers that present challenges to widespread implementation of such TAs. The examples presented in this paper show how to involve stakeholders in the process of evaluating the local and available capacity to adopt and implement desirable TAs, e.g., through Delphi exercises, workshops, symposia, and on-line and personal interactions. These evaluations will enable identification of capacity development needs to address the problems and issues – a key product of the foresight. A dialog can then begin on strategies and plans to develop the human, physical, and institutional capacity needed to address critical problems and issues within the "local" context. This dialog, aimed at establishing goals, objectives, and a timeline, should simultaneously appeal to clients, stakeholders, and the public, and provide a vehicle for continuous iteration of the foresight process.

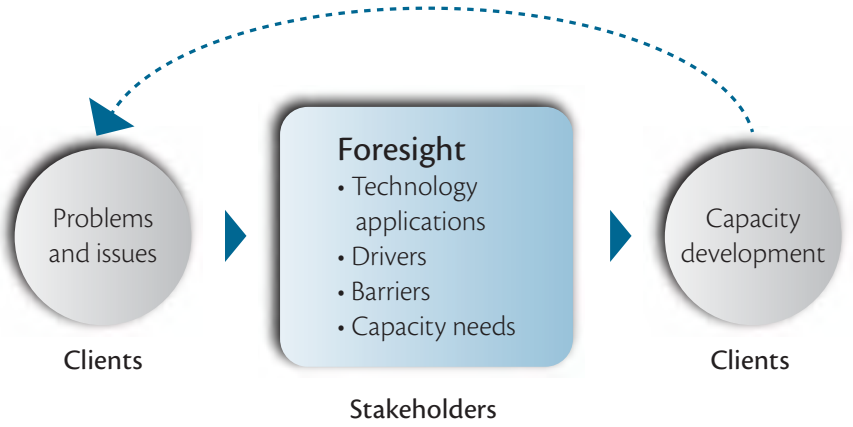


Figure 3 - Schematic representation of the foresight process

Methods and tools for breaking mindsets and bringing new perspectives to the table

Ron Johnston*

The evolution of foresight

As foresight has moved into common practice as a tool to assist planning and strategy over the past 20 years, it has undergone a significant process of evolution.

One way of tracing this evolution is to compare the definitions of foresight used over this period. A selection is presented below:

- foresight is a tool or set of tools used "to survey as systematically as possible what chances for development and what options for action are open at present, and then follow up analytically to determine to what alternative future outcomes the developments would lead." (1989)[1]
- a systematic means of assessing those scientific and technological developments which could have a strong impact on industrial competitiveness, wealth creation and quality of life. (1996)[2]

The emphasis on priority setting for science and technology was substantially broadened in the 21st century, leading to definitions such as:

- Foresight is a means of systematically addressing the future, and acting on it.[3]
- Foresight is a systematic, participatory, future-intelligence-gathering and medium-to-long-term vision-building process aimed at present-day decisions and mobilising joint actions.[4]

* Australian Centre for Innovation University of Sydney

1 Martin, B. and Irvine, J., *Research Foresight: Priority-Setting in Science*, London-New York, Pinter Publishers, 1989.

2 Georghiou, L., 'The UK Technology Foresight Programme', *Futures*, Vol 28, pp. 359–377.

3 Johnston, R., APEC Center for Technology Foresight, 2005.

4 IPTS FORLEARN, *http://forlearn.jrc.ec.europa.eu/guide/A1_key-terms/foresight.htm*

Another way that this is captured is via the concept of 'generations of foresight'. Thus Johnston[5] proposed five stages in the chronology of foresight, with technology forecasting and futurism leading to technology foresight, from which emerged foresight, with its wider understanding of the economic and social processes that shape technology. He notes the strong progression within foresight studies towards being embedded within and directed towards planning and decision-making processes at a level appropriate (frequently local or sectoral) to the responsible organisation.

This approach was amplified Georghiou et al[6], who argued that the development of foresight can be characterised in terms of five generations of activity, in an analogous manner to the five generations of innovation:

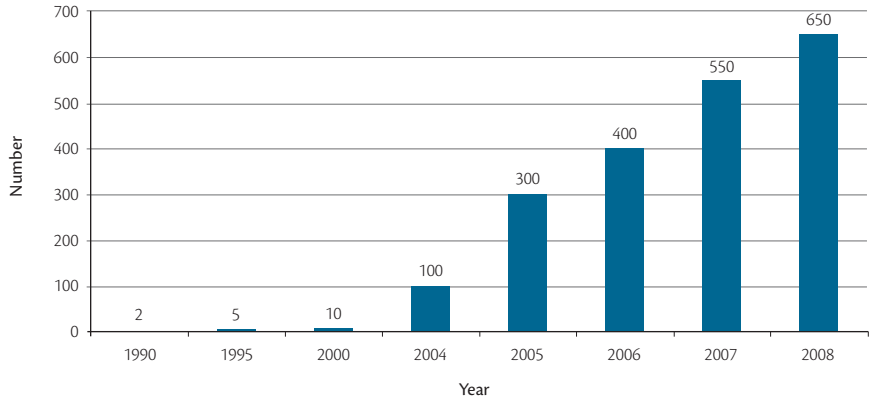
1) *First Generation:* Foresight is emerging from what are mainly technology forecasting activities, with the analyses driven mainly by the internal dynamics of technology.
2) *Second Generation:* Foresight projects seek to grapple with technology and markets simultaneously. Technological development is examined in terms of its contribution to and influence from markets; there is also a strong emphasis on matching technological opportunities with market developments (and also with non-market needs such as environmental and social problems).
3) *Third Generation:* Foresight's market perspective is enhanced by inclusion of a broader social dimension, involving the concerns and inputs of a broader range of social actors. The need to take into account complicated issues concerning social trends and alternative institutional arrangements means that the methods used and the knowledge bases drawn on have to be expanded to deal with such issues.
4) *Fourth Generation:* Foresight programs have a distributed role in the science and innovation system, rather than being "owned" by a single policy sponsor. Multiple organisations sponsor and/or conduct exercises that are specific to their own needs, but are coordinated with other activities (eg sharing resources and results, having shared working groups).
5) *Fifth Generation:* A mix of foresight programs and exercises, also distributed across many sites but in combination with other elements of strategic decision-making. The Principal concern of these activities is either (a) structures or actors within the STI system, or (b) the scientific and technological dimension of broader social or economic issues.

These shifts need to be understood and interpreted within the remarkable growth of foresight

5 Johnston, R., 'The State and Contribution of International Foresight: New Challenges', *The Role of Foresight in the Selection of Research Policy Priorities*, IPTS Seminar, Seville, pp. 13–14 May 2002

6 Georghiou, L., Cassingena Harper, J., Keenan, M., Miles, I., and Popper, R., *The Handbook of Technology Foresight*, Edward Elgar, 2008, pp. 15–16.

over this period. Precise quantitative data of the number of projects that have been conducted are unavailable, given problems of definition and access. Nevertheless an approximate, judgment based exercise by the author, drawing on a number of other reviews, presented in Graphic 1, provides an indication of the scale of exponential growth.



Graphic 1. Growth of foresight activity

As a consequence, there is a general agreement among foresight practitioners that:

- future-oriented thinking is vital for any forward planning, decision-making or policy development to meet future challenges;
- foresight enhances such thinking by gathering strategic anticipatory intelligence
- there are a variety of tools available to conduct foresight; each has a different basis, different strengths and limitations, and different applicability; and
- foresight is most effective where it is directly linked to existing planning and decision-making tools which are addressing specific issues of the future.

Moreover, the primary objectives of foresight exercises should be to:

- gather intelligence on possible longer-term developments and how these may interact with the decisions made today;
- provide strategic visions and create a shared sense of commitment to these visions among participants and stakeholders;
- build networks that bring together people from different sectors and institutions; and
- provide alerts on major future risks and opportunities.

This evolution of foresight has seen a significant transformation in many of its characteristics beyond just definitions. A wide range of applications have been developed, including for example:

- identification and characterization of emerging technologies;
- establishment of research priorities;
- planning for industry sectors;
- natural resource management;
- business strategy formulation;
- driving innovation into a supply-chain;
- regional economic development; and
- education.

There have also occurred major shifts in a number of features of foresight exercises:

- the emphasis of the majority of foresight projects has moved away from the development and demonstration of methods to a greater focus on outcomes and policy;
- the view of foresight methods as highly specialised tools, which can me comprehended and applied only by the trained foresight specialist is progressively being replaced by a recognition of the value of embedding foresight tools as a standard management practice;
- while national foresight studies continue, the predominant focus has shifted from national to the regional, sectoral, and local level and within organisations and communities – the experience is that national foresight studies represent the most difficult case, merely because of their breadth and the logistics management requirements; more focussed exercises are far easier to design, manage and implement;
- the sphere of primary application has moved beyond priority-setting for public research to include planning and decision-making, innovation, technology transfer – indeed all aspects of planning and management of an STI system;
- as suggested above, the scope has broadened from a primary focus on the technological dimension to fully incorporate broader socio-economic, environmental and social outcomes.

Experience is also being accumulated[7] about different socio-economic and cultural contexts for the application of technology. For example, In Western predominantly market economies (e.g. US, UK, Germany) identification of potential key technologies operates as a signal and information to which private sector corporations can respond. In contrast, in more planned Eastern economies (e.g. Japan, Korea) public investment in research and technology development can be more explicitly steered through foresight studies.

Changing mindsets

Within the foresight discipline, it would be commonplace to identify one of its functions as the changing of mindsets ie shifting thinking about future possibilities. Interestingly, though, there appear to be relatively few explicit references to changing mindsets. A detailed search of the foresight literature by the author identified only a small number of citations to the specific phrase.

These include:

> *Foresight is about changing mindsets. Foresight is not centralised planning. Rather, it is a process where we generate, and keep generating, a shared sense of where we wish to go as a society. It is about being better prepared for the future, by understanding key trends, uncertainties and influences and drivers that will shape the way the future develops.*[8]

> *Scenario-planning is a tool used in Technology Foresight exercises to test the strategies being proposed for each sector for their relative robustness in the face of any combination of future uncertainties. This approach… facilitates large companies, smaller enterprises, the public sector partners and researchers to break out of the constraints of thinking about the future based only on current experience and trends. The systematic process of Technology Foresight can, therefore, be of immense value in fostering a new shared mindset amongst the partners.*[9]

---

7 For example, through IPTS FORLEARN activities in disseminating foresight skills to new and prospective member States of the EU, and through projects of the APEC Center for Technology Foresight involving a range of Asian APEC Member States eg Vietnam, Laos, Myanmar.

8 The Foresight Project, *Sci-Tech*, Newsletter from MORST 8 (3) August (1997), p. 1, cited in Martin, B., and Johnston, R., 'Technology Foresight for Wiring Up the National Innovation System', *Technological Forecasting and Social Change*, 60, pp. 37–54 (1999).

9 Technology Foresight Ireland – *http://www.forfas.ie/icsti/statements/tforesight/overview/tforeire.htm*; note the emphasis is on a shared mindset rather than a changed mindset.

In addition, an analysis of the use and impact of foresight mentions that the foresight process "can reduce uncertainty because participants can align their endeavours once they arrive at shared visions" and that users of foresight place value on it, among other reasons, because it provides "a means to challenge and catalyse staff and stakeholders."[10]

In practice, it can be concluded that while part of the rhetoric of foresight has been about challenging mindsets and establishing new visions, the predominant emphasis has been on getting foresight accepted as good practice, a standard tool of planning and management, appropriately adapted to the environment it is seeking to influence.[11]

The remainder of this paper will address the concept of mindsets, their efficacy and constraining characteristics, the need to challenge mindsets, and some approaches that might be incorporated into foresight to more effectively achieve this goal.

So what is a mindset? A mindset is a set of assumptions, methods or notations held by one or more people or groups of people which is so established that it creates a powerful incentive within these people or groups to continue to adopt or accept prior behaviours, choices, or tools."[12]

Snyder[13] argues that humans (and all creatures for that matter) are profoundly shaped by our adaptation to our environment, which means that our survival depends critically on our ability to rapidly identify and interpret key information. The very price of this survival is that we have adopted mental paradigms which exclude alternative possibilities and apparently extraneous data.

> *It would appear that we are all blinded by our mental paradigms – by our mindsets! We emphatically do not examine each situation anew by logically considering all possibilities. Instead, we look at the world through our mindsets, mindsets acquired from our past experiences. Put simply, we are intrinsically prejudiced...*
>
> *This world has an indefinite number of potential surprises, but only a restricted subset is of critical importance to an animal. And, this subset is dictated by the animal's lifestyle*

10 Havas, A., and Johnston, R., 'The Use and Impact of FTA', Third International Seville Seminar on Future-Oriented Technology Analysis, 16-17 October 2008, accessible at *http://foresight.jrc.ec.europa.eu/fta_2008/anchor_paper_2.pdf*

11 Eriksson,E. and Weber, M., 'Adaptive Foresight: navigating the complex landscape of policy strategies', *Technological Forecasting and Social Change*, Vol 75, 2008, pp. 462–482.

12 Wikipedia

13 Snyder, A., 'Breaking Mindset', *Mind and Language*, Vol 13, 1998, pp. 1–20.

> *within its niche. If the animal is to be a master of its niche, an expert as it were, then it must react automatically to those things of importance.*
>
> *Mental paradigms – mindsets – make possible this automatic behaviour. But, the price for mindsets is fixed modes of thought and hence prejudice.*

Should we then seek to systematically rid ourselves of our constraining mindsets, to construct a world free of reliance on mental paradigms?

> *True, such a mind would be more conscious of detail and hence potentially aware of alternative interpretations... But a mind without paradigms would have no language, no communication abilities and no thought as we know it. Communication, language and thought are symbolic systems. They all require mental paradigms. Such a mind would have difficulty in coping with anything but the simplest routines, because the world would be one of continual surprises. Everything would have to be examined anew by treating each detail with equal importance. This does not look like the recipe for conceptual leaps, let alone creative genius. Rather, this is a mind that is overwhelmed and bogged down in detail. In fact, a mind without paradigms appears to me like one with infantile autism.*[14]

The explanatory power and limitations of paradigms was famously used by Thomas Kuhn to describe and explain the nature of scientific progress. Kuhn argued that science does not progress via a linear accumulation of new knowledge, but undergoes periodic revolutions, or paradigm shifts in which the nature of scientific inquiry within a particular field is abruptly transformed. Guided by the prevailing paradigm, normal science is extremely productive: "when the paradigm is successful, the profession will have solved problems that its members could scarcely have imagined and would never have undertaken without commitment to the paradigm."[15]

During the period of normal science, the failure of a result to conform to the paradigm is generally seen not as refuting the paradigm. However, as anomalous results build up, science reaches a crisis, at which point a new paradigm, which subsumes the old results along with the anomalous results into one framework, is accepted. This is termed *revolutionary science*. Kuhn argues that rival paradigms are incommensurable – it is not possible to understand one paradigm through the conceptual framework and terminology of another rival paradigm.

---

14 Ibid, pp. 2–3

15 Kuhn, Thomas, *The Structure of Scientific Revolutions*. University of Chicago Press. pp. 24–25, 1962.

How then to escape the power, and the trap, of mindsets? Snyder proposes that, as we can not easily break them, an appropriate response is to multiply them.[16] Alternative mindsets can be generated by working in completely different fields, or exposing ourselves to very different cultures.

The challenge for foresight then, may be less the direct breaking of particular mindsets but rather the creation of a range of possible mindsets and the mental and psychological capability to readily migrate from one to another. This may be a particularly important task because of the scale of the challenges we face.

Addressing the grand challenges to our future

There are any number of grand challenges to the future of humanity and our planet. It may be argued that it was ever thus, and our perception is inevitably shaped by our own condition and experiences. Nevertheless there appears to be sufficient evidence from a wide range of different sources to suggest these challenges are very real, and threatening.

Among these challenges, drawn from many reports are:

- Food availability
- Energy availability
- Water availability
- Climate change
- Population and demographics
- National and personal security
- Transforming effects of cyberspace and social networking
- Managing increasing complexity
- Emergence of a multi-polar world. With increased power shifting to non-state organisations.

At the same time, we are witnessing a loss of legitimacy and authority of institutions, and of codified formal knowledge, which would appear to significantly transform thr mechanisms available to arrive at collective agreement on the nature of the grand challenges and the best measures to address them.

16 Snyder, op cit, pp. 7–8.

One set of statistics about the growth of social networking reports:[17]

- 234 million people age 13 and older in the US used mobile devices in December 2009;
- Twitter processed more than one billion tweets in December 2009 and averages almost 40 million tweets per day;
- Over 25% of U.S. internet page views occurred at one of the top social networking sites in December 2009, up from 13.8% a year before;
- Australia has some of the highest social media usage statistics in the world. In terms of Facebook use Australia ranks highest with almost 9 hours per month from over 9 million users;
- The number of social media users age 65 and older grew 100 percent throughout 2010, so that one in four people in that age group are now part of a social networking site.

Apparently, in the age of Internet-based social networking, traditional expert knowledge is losing its former authority. For some, this is a welcome move toward more democratic processes:

> *The empowering capability of ICTs is centered on their ability to permit previously marginalized individuals and groups – who would otherwise be silent and invisible – to be heard and seen. By doing so, ICTs reveal the diversity in society, a range of opinion that has always existed, but was previously without voice in public decision making. This, in part, is due to the fact that ICTs facilitate the dispersal of power away from centralized governments with the result that rational, administrative institutions are being challenged as a sole means of political and social control. In what appears to be a worldwide phenomenon, bureaucratic institutions are losing their monopoly over key sources of information and the capacity for surveillance, permitting alternative voices in civil society to emerge.*[18]

An alternative view is that:

> *the traditional control of knowledge, involving specification, standardization, and validation, by professors, teachers, researchers and experts, is paradoxically challenged and amplified at the same time. It is challenged by alternative, more individualized re-expression of traditional knowledge, and because new areas of application gain recognition. At the same time, the appearance of experts on the mass media scene, as providers of explanations and background commentaries, and in the market arena, as consultants, has opened new*

17 Wikipedia

18 Milakovich, M., 'The Internet and Increased Citizen Participation in Government', *Journal of Democracy*, Vol.2, pp. 1–9, 2010.

> *control opportunities for knowledge owners, as suppliers of rationality, according to a just-in-place and just-in-time logic.*[19]

A more strident opinion is that:

> *Out of this anarchy, it suddenly became clear that what was governing the infinite monkeys now inputting away on the Internet was the law of digital Darwinism, the survival of the loudest and most opinionated. Under these rules, the only way to intellectually prevail is by infinite filibustering.*[20]

It appears safe to conclude that new approaches to engage the community in understanding and addressing the grand challenges which many believe we face will require the positive use of all the tools of education and communication available.

In addition to the challenges to institutions and knowledge, the nature of the problems themselves that we face are raising new challenges. This is best captured by the now familiar concept of 'wicked' problems.

Wicked problems have a range of interacting characteristics:

- difficulty to clearly define – the nature and extent of the problem depends on who has been asked ie different stakeholders have different versions of what the problem is;
- many interdependencies, often multi-causal – which make them hard to clearly define; the disagreement among stakeholders often reflects the different emphasis they place on the various causal factors;
- attempts to address them often lead to unforeseen consequences;
- often not stable – a wicked problem and the constraints or evidence involved in understanding the problem are often evolving at the same time that attempts are being made to address it;
- usually have no clear solution – since there is no definitive, stable problem there is often no definitive solution to wicked problems; solutions are not verifiably right or wrong but rather better or worse or good enough;
- social complexity – this, rather than technical complexity, overwhelms most current problem-solving and project management approaches;

---

19 Skagen Roundtable, 'Sharing Knowledge and Experience in Implementing ICTs in Universities', 2001, accessed at *http://www.iau-aiu.net/he/icts/rtf/icts_confskagen1.rtf*.

20 Keen, A., *The Cult of the Amateur*, Random House. p.15, 2007.

- rarely sit conveniently within the responsibility of any one organisation – they require action at every level, from the international to the local and by the private and community sectors and individuals;
- involve changing behaviour – innovative, personalised approaches may be necessary to motivate individuals to actively cooperate in achieving sustained behavioural change.[21]

Taken together, the features of the wicked problems suggest the need for alternative and multiple mindsets is urgently required.

Foresight approaches to challenge mindsets

Perhaps the most important conclusion to draw from this analysis is that foresight which is transformative, or designed to challenge and change existing mindsets has different characteristics from adaptive or managerial foresight. The 'rules' which have been evolved to design and conduct the latter type of foresight with the objective of consensual change are not appropriate to the pursuit of changed mindsets and new perceptions. A different type of approach is needed.

A number of techniques have been developed specifically to facilitate the process of foresight designed to challenge existing mindsets. In particular, the literature on the management of strategic decision-making based on conflictual rather than consensual approaches would appear to offer some insights. Efforts to build conflict into strategic decision making have focused on two similar approaches, dialectical inquiry and devil's advocacy:

> *Both approaches incorporate decisional conflict through formalized debate. A decision-making group is divided into two subgroups, each of which will be involved in the analysis and solution of the problem at hand. One subgroup develops recommendations and supports them with all key assumptions, facts, and data, all of which are provided to the other subgroup.*
>
> *At this juncture, the two approaches differ. In dialectical inquiry, the second subgroup develops plausible assumptions that negate those of the first, then uses these new assumptions to construct counter-recommendations. The two subgroups debate their assumptions and recommendations in a process that continues until they agree on a set of assumptions, whereupon they unite to develop recommendations based on those*

21 Adapted from 'Tackling Wicked Problems: A Public Policy Perspective', Australian Public Service Commission, 2007, accessed at *http://www.apsc.gov.au/publications07/wickedproblems.htm*

assumptions. In devil's advocacy, on the other band, the second subgroup subjects the assumptions and recommendations of the first to a formal critique, expounding upon their flaws and why they should not be adopted but offering no alternative.

The first subgroup revises its assumptions and recommendations to satisfy the valid objections of the second subgroup, then presents them for a second critique. The process continues until both subgroups can accept the assumptions and recommendations.[22]

Another approach is based on the explicit creation of more 'extreme' scenarios. There is a well-known tendency in scenario construction to reject more radical events as 'not possible' or 'highly improbable'. Foresight practitioners rarely wish to attract the criticism of 'science fiction', 'fanciful', or 'total rubbish'. It may be important to resist this conservative tendency in foresight exercises designed to challenge mindsets.

Other approaches in the same vein include the introduction of highly challenging 'wild cards', the explicit construction of fantasy (sometimes by engagement of a creative writer), and the inclusion in the process of people who, by their nature are highly creative, out-of-the-box, thinkers, rather than experts. Indeed, based on the follow-up evaluation of the Japanese NISTEP exercises[23], experts are likely to be more accurate about short-term developments, but les accurate than non-experts in predicting longer-term developments.

In addition, the more conventional tool of 'stretch targets' can be applied to push scenarios beyond conventional limits. For example, a foresight exercise built around the stretch target of reducing carbon dependence to zero in five years might be rejected as implausible, but might also serve to identify the kind of technological, economic and institutional breakthroughs that would be needed to achieve the target.

22 Schweiger, D., Sandberg, W. and Rechner, P., 'Experiential Effects Of Dialectical Inquiry, Devil's Advocacy and Consensus Approaches To Strategic Decision Making', Academy of Management Journal, Vol. 3Z. pp. 745–772, 1989.

23 Accesssed at *http://www.nistep.go.jp/achiev/ftx/eng/mat077e/html/mat077ee.html*

Conclusions

On the basis of the analysis of this paper, and the extensive experience of the author, it is now possible to initiate the task of identifying the necessary elements of a *Charter of Good Practice* for both the managerial (adaptive) and transformational (mindset challenging) forms of foresight at the national level. I propose the following:

Charter of Good Practice in the managerial application of foresight

1) A well-resourced over-the-horizon scanning capacity
2) Significant analysis of weak signals of change
3) Planning and decision-making conducted within a significant future-oriented environment
4) 'What if ?' analysis embodied as a regular component of risk analysis and management
5) Regular web-based engagement of multiple perspectives
6) Strategic conversation as a recognised KPI
7) Routine roadmapping towards defined objectives
8) Staff trained in use of foresight tools in all major Government Departments and Agencies

Charter of Good Practice in the transformative application of foresight

1) A Strategic Intelligence Unit (SIU) at the level of the Cabinet Office, or equivalent with responsibility for raising challenging issues and options
2) SIUs or SI capacity in every major government department and agency
3) Mechanisms for collaboration, coordination and exchange of information between all SIUs
4) Application of transformative foresight techniques
5) Regular production and communication of SIU analysis and findings
6) Establishment of an appropriate community of practice around each SIU
7) Open communication models with all information routinely available to the public
8) Engagement with all forms of media to promote a reflective future orientation

IT Systems and Technological Prospective: some insights from a real-time delphi experience at an aerospace firm

Denis Balaguer*

Introduction

The innovation has and intrinsically uncertain nature. This uncertainty is essentially a result of the complexity of the products, technologies and markets and of the temporal dimension – it is impossible to precisely access the future.

Notwithstanding, anyone dealing with the innovation management must cope with this uncertainty. The objective of the prospective thinking is to systematically deal with elements of uncertainty and support the innovation decision-making process.

One of the largely used prospective processes is the scenario building. Scenarios are coherent narratives of some possible futures and intents to improve the robustness of the innovation planning by providing a probabilistic assessment of what might happen.

The development of scenarios are subjected to several institutional constrains, especially the need for quantifications and engagement issues that emerges with the use of Delphi surveys, which are a chief approach to the scenarios building.

The Real-Time Delhi (RTD) is one the solutions proposed to improve this process, by using IT systems to streamline the interaction with the experts.

---

* Strategos: When this paper was presented in December 2010, the author was Chief Technology Strategist at Embraer, where most of the experiences reported here were developed. The opinions presented in this article are of entire responsibility of the author and do not reflect positions of neither Embraer nor Strategos.

The present work describes the prospective process of an aerospace firm and reports the use of RTD in the scenarios building. Some insights from the trenches are also presented.

Innovation in the aerospace industry

The commercial leadership of the aeronautical industry is strongly driven by the continuous innovation introduction on its products (SHERRY, SARSFIELD, 2002, p. 1). This fact is empirically demonstrated by the broad analysis developed by Phillips (1971), which states, "a basic element causing structural changes in the commercial aircraft industry was a scientific and technological environment which was itself changing" (p. 3).

The market structure, i.e., the configuration of the evolutionary process of making winners and losers at the industry competition, is strongly related the capacity of keeping the pace of the technical change and introducing innovations. As Phillips put it,

> *A progressing science which is related to the products and processes of particular industries operates on markets in ways such that some firms tend to become larger, more profitable, and more technological progressive while others experience increasing difficulties in remaining viable (1966).*

The history of the aeronautical industry fully illustrates that process, with an increasing concentration of the market (PHILLIPS, 1971; COMMISSION ON THE FUTURE OF THE UNITED STATES AEROSPACE INDUSTRY, 2002), therefore, it is critical for the firms in the industry to manage properly the technological innovation process in order to keep competitive. Nevertheless, this is not a trivial task, given the innate uncertainty nature of the technology innovation, especially at the aeronautical industry.

As Phillips, put (1971, p. 127)

> *A number of advances in science and technology relating to aircraft manufacture have been traced (...) [but] many of these occurred for reasons quite unrelated and, often, quit antecedent to their use in the production of commercial aircraft. The advances, nonetheless, provided opportunities and incentives for manufacturers of commercial aircraft to develop new types of planes (...). [Between the late 1920s and the mid-1960s T]he number of manufacturers of commercial planes has decreased radically and there have been shifts in the marketing share of the remaining ones. (...) Some of the manufacturers*

erred by failing to develop new aircraft types which technological changes were making possible. Others erred by attempting types which, except with enormous development costs, were not technical feasible. A few – and only a few – succeeded in avoiding these mistakes and, thus, in maintaining a position in the marked.

To cope with this inherent uncertainty nature, the technological innovation manager must master the complexity of the aeronautics development, which imposes long and integrated developments cycles to the industry resulting in higher risks (Figure 1).

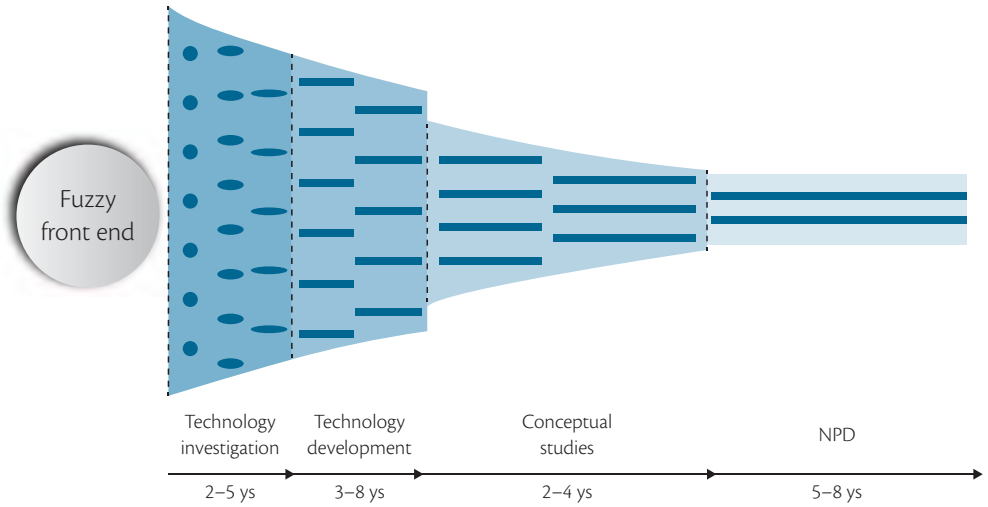


Figure 1 - The aerospace innovation's technology transfer cycle

As stated by the US Senate Armed Services Committee - Subcommittee on Acquisition and Technology (1997):

(...) aeronautics R&T advances are evolutionary, and a substantial number of years can pass before the aviation systems making use of these advances enter service. Modern aircraft are complex "systems of systems," and advances in one discipline, such as aerodynamics, may require an advance in another discipline, such as structures, before they can be applied in a new aircraft design. Years of validation, testing, and certification are, therefore, usually required before a new aeronautics R&T development can be exploited.

In order to build a master plan to deal with the innovation complexities, one must seek for explanatory models to support a broader understanding of the process. Nelson and Winter (2006) discuss an generic model for innovation. In this model, there two different moments in time, called Search and Selection, being the "Search" the routines of technology change – or the routines to modify routines (NELSON &WINTER, 2006)

> *denote all those organizational activities which are associated with the evaluation of current routines and which may lead to their modification, to more drastic change, or to their replacement (p. 400)*

The Selection is the moment when a competitive selection of the innovation occurs in the market, determining the advantage of some firms over others.

This model is build upon the Schumpeterian understanding of innovation. Schumpeter reminds the equal weight of the application of these new technologies – "as long as they are not carried into practice, inventions are economically irrelevant" (SCHUMPETER, 1982). It means that, without a market application of the inventions, there are no innovations, and consequently no extraordinary gains.

Therefore, in order to manage the innovation rationally, it is mandatory to understand both aspects on innovation: technology and market. More specifically, in order to fill the projects portfolio at the Fuzzy Front End moment, the innovation manager must answer two questions: "which will be the market requirements?"; and "which technologies will determine competitiveness?"

How to look far ahead in the future?

The founding concept of the present work is the perception that the future is the result of a tradeoff between the social actors and the scientific and technological development, considered the power asymmetries.

This vision is particularly supported by Michel Godet, when he says that:

> *although Prospective is not well known in Anglo-Saxon forecasting literature, it has been for many years used in France... The main characteristics of 'La Prospective' are that it does not look at the future as a continuation of the past but rather as the outcome of the wishes various actors and the constraints imposed on them by the environment. Its purpose is to assist in creating alternative futures and then to select some alternative that allows for maximum freedom of action (1982).*

And also

> *emerging from the deterministic influence of the past and the present, on the one hand, and the choices, will, action of the present, on the other (GODET, 1979 apud MASINI, 1993, p.15).*

But it is important to consider that technological forecasting is not about predicting the future. It is about probabilistically understanding the forces that will shape the convergence towards the future (Balaguer, 2005). Michel Godet (1999) once stated that the future is multiple, undetermined and open to a great range of different possible futures.

Considering the need to model the economic change, in a macro-aggregation level, it is necessary to deal with the complexity. Masini states that

> *In Future Studies we are therefore dealing with complex systems that become even more complex in the case of social systems. The situation of uncertainty must thus be examined in relation to complexity. It is important that we detect a situation of risk and uncertainty in a complex present. Even in our normal everyday lives we have accepted risk and uncertainty; we have to face up to them and try to understand them with the tools that are gradually being developed. Futures Studies will never be able to give us certitudes, but they can help us to lower the level of uncertainty through a careful structuring and analysis of problems (1993, p. 36).*

This outlook of the approaches to deal with a prospective attitude, and a need to understand the future, leads to some insights:

a) The future is a clean sheet, full of possibilities: The future is yet to be constructed, and one interested in developing a panorama of what might happen must take anything for granted.
b) But nothing comes from nothing: Notwithstanding the full range of possibilities, the forces that will drive the future are already present today. One should, this way, try to understand which are the present trends that have power to influence the future.
c) In order to handle the uncertainty, one might build a model to simulated changes and possible configurations of the future: With the possibility to understand some of the forces driving the future, one might be able to build a model – i.e., a simplified understanding of a system – of how this forces interact and which are the outcomes.
d) From an institutional point of view, it is important to create awareness: Since the idea is not prediction the future, but understanding the present and constructing analytical assessments of the future, the need for an strategic dialogue is vital. This way,

one might created a sense of awareness of what might happen and how it will happen, instead of given a false comfort of a prediction.

e) The process of future assessment should combine quantitative and qualitative tolls in order to accommodate institutional culture: given that the dialogue within the organization is a chief necessity, one should take in account how the organization thinks and makes decisions.

Some methodological concepts and Embraer´s approaches

Uncertainty has a non-reducible nature; notwithstanding, risk could be measured and though managed. The technological prospective is the broad field that propose methods and processes to deal with the risks related the future.

By technological prospective, the present work is adherent to the definition given by Balaguer (2005, p.21):

> *Technological Prospective is both a process that looks to the future and the results of this process, which anticipate, extrapolate or forecast capacities, applications and functionalities of machines, process and techniques. The technological prospective process must look for understanding the forces that will shape the convergence between the possible, plausible, probable and desirable futures, integrating technical and non-technical considerations. This way, it must be explored a probabilistic statement which dismisses the uncertainty and increases the level of information about the future. The process outcomes, expressed in words or numbers, are showed in a useful way to the decision and policy makers, consequently increasing their state of alert about future's threats and opportunities. (BALAGUER, 2005, p.21)*

This definition, elaborated aiming a broad understanding of what must be the technological prospective, uses some conceptual definitions (both for forecasting and foresight) given by several authors like Millet and Honton (1991), Masini (1993). McHale & Cordell McHale (1976 apud MASINI, 1993, p.15), Jantsch (1967), Martino (1983), Ascher (1978 apud MILLET, HONTON, 1991, p.2), Zackiewicz e Salles-Filho (2001) and Coates (1985).

Under this broad definition and handling the "Search" and "Selection" conceptual framework, Balaguer et al (2007) proposes a method to understand how the technology might affect the competitive environment in a future aerospace market.

Starting with the complexity understanding of the innovation process at the aeronautical industry, because "technological innovation is increasingly concerned with complex products and processes"

(KASH AND RYCROFT, 2002) the authors states that "when it's necessary to manage an innovation process involving high-complexity products (...) it's mandatory to deal with extra dimensions." (BALAGUER ET AL, 2007).

First it is important to understand that aircrafts do not care an univocal relation with any single technology – despite the that the product architecture must be considered an technology itself –, but are an assemblage of systems and sub-systems, or as Mowery and Rosenberg states, a central characteristic of the innovation process in this industry is the "systemic complexity of the final product" (1981).

This first characteristic implies that one must understand the future product as a concept product, which embodies the complex assembly of technologies to the market, instead of studding the future of a single chosen technology. This approach to futures studies, i.e., applied to a product as hole, is called Product Forecast by Millet and Honton (1991), who says that

> *indeed, in the corporate context (...), "product forecasting" may be more descriptive of what are really attempting than "technology forecasting". This new term opens up horizons for integrating technologies with non- technical considerations in a comprehensive package that would be more useful to managers.*

In second place, Balaguer et al (2007) observe that, when dealing with such complex products, and the long cycles and technological maturity issues associated with them, it may be dangerous to choose a single set of future market assumptions. A set of alternative futures "allows decision makers to compare and contrast how a particular future (...) might evolve" (FAHEY AND RANDALL, 1998). So, one must develop a prospective study that brings to parallel future worlds a whole set of market drivers that feed the product concepts, and then by extension, the technologies.

It's also important to remember that the objective of an alternative set of scenarios isn't pick up the most probable and then put all the bets on this, but take strategic decisions that are plausible considering all the possible futures (SCHWARTZ, 2000).

Another important consideration done by Balaguer et al (2007) is the technological innovation framework proposed. This Framework (Figure 2) is build upon the aspects of the innovation process of high-complexity products explored above, and proposes a set of four organizational dimensions to deal with the innovation process inside a firm, composed by: "Corporate Strategy"; "Marketing"; "Conceptual Studies & Design"; and "Research & Development".

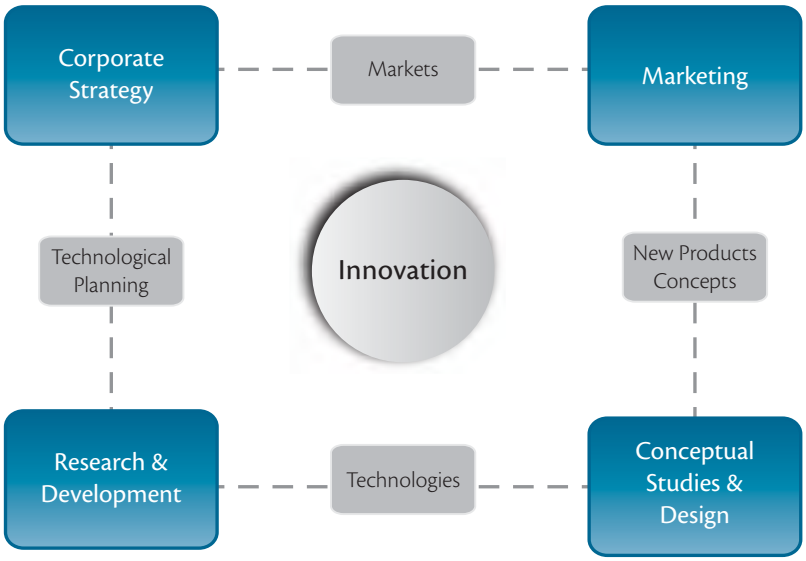


Figure 2 - The four organizational dimensions for the innovation process of high-complexity products

Source: BALAGUER ET AL, 2007

The first area, "Corporate Strategy", represents the corporate search for the future of the firm, the normative vision of the overall strategy. In this dimension it is established what the firm wants and what the firm will do - the main business drivers.

In the "Marketing" dimension, the overall strategic drivers are used as inputs to determine the market-target. The "Marketing" dimension translates the firm's strategy into market drivers, which are the requirements and attributes to guide the product development. Is particularly important to understand those market drivers, since an innovation of product must bring a new technology to an identified, or even potential, market need.

"Conceptual Studies & Design" is the dimension responsible for the deployment of the market requirements into products characteristics, i.e., to translate market drivers into products functionalities.

The "Research & Development" area is the dimension that translates the products conceptual design, and especially the technical requirements, into technological needs.

Linking those functional dimensions, are the objects that interface the four dimensions:

- "Markets" – represent the niche segments that are most representatives to the corporate strategy.
- "New Products Concepts" – are the deployment of the market requirements into product characteristics.
- "Technologies" – are the means of compliance of the product technical characteristics.
- "Technological Planning" – is a special interface that feedbacks the strategic vision with technological analysis. It's a important interface given the fact that a new technological capability may influence a revision in the firm's strategy plan.

Based on this Technological Innovation Framework, Balaguer et al (2007) propose an prospective process which main purpose is to emulate the innovation process describe by the Framework, and, this way, accessing the future Selection environment. The process proposed by the authors (Figure 3) is divided in three main steps: Prospective Scenarios Building; Possible Products Design; and Technologies Needed Determination.

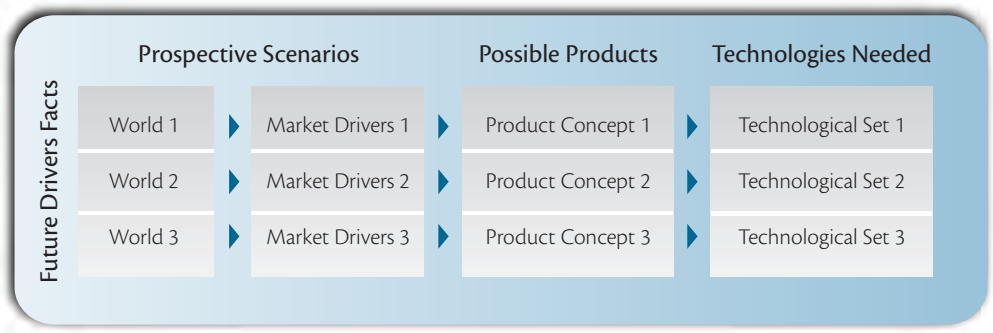


Figure 3 - Technological Prospective Method for Innovation in High-Complexity Products

Source: BALAGUER ET AL, 2007

The first step of the method, the Prospective Scenarios Building, comprises the elaboration of alternative views of the future, considering the world as a whole, that is, considering different aspects of the world such as economy, geopolitics, social and technology.

The process begins with the analysis of future driver facts that must be collected during a prior period of time- a year for example - on any kind of reliable information source: newspapers, magazines, scientific publications and so on.

Future drive facts can be understood as facts or events in the present time that give clues of how the world is changing or will change. For example, "The congress gives 'go ahead' on the proposal that relocates financial resources from military research to education". One can infer that the world is moving to a warless scenario.

The future driver facts must be selected regarding the influence on the main theme of the exercise or the organization.

Once selected, the future driver facts are grouped on its related domains. These domains can be, for example, economical, social, geopolitical, cultural or technological. Based on the selected future drivers facts, one must write down events.

An event is a sentence that describes a feasible and plausible deployment of the future driver fact. Considering the example of the congress 'go ahead' above, a feasible event could be: "GDP will grow based on high education level of the population".

The events must be evaluated at this moment. To perform the evaluation, a group of experts on the events domain is consulted. The experts must be chosen inside and outside the organization to avoid biases. It is used the Delphi technique to make the evaluation. At the end of the Delphi process, each event must be assigned with an occurrence probability, independently of the other events.

Using this information set (events and occurrence probability), a cross impact matrix is build and the conditional probability is analyzed, that is, each event is assigned with an occurrence probability since you know that other event has already occurred. This matrix has n x n dimension where n is the event's number.

From the cross impact matrix, multiples combinations are created combining the occurrence or not occurrence of each event, resulting in a 2^n set of combinations. Using this information, one must select a number of combinations that will be analyzed as alternative views of the future.

Three alternative views of the future are defined as three different combinations got from the result of cross impact matrix analysis. It means that, from 2^n combinations, three are selected.

The criteria to select the three combinations of events are: the most likely to happen, one that should be beneficial to the organization and, finally, the most dangerous.

Each one of the selected configurations is used as a composition framework. This task should results in consistent stories about the future. These consistent stories are called scenarios.

For the purpose of the present work, this first stage (Scenarios Elaboration) is the most interesting one, since it's the one that the IT systems experience were developed. This IT experience is an answer to some of the important methodological issues that the scenarios approach pose:

a) **Engineering culture:** When a firm has a strong engineering culture and therefore loves quantitative results it is necessary to integrate into the scenarios some numerical probability assessment. One way to deal with this is with Delphi surveys, where experts estimates the probabilities of the variable components of the scenarios
b) **Delphi:** One problem with Delphi surveys is the engagement issue and how to avoid boring the experts. Several rounds and too many questions tend to alienate the participants through the process.
c) **Avoid information going wrong:** When dealing with Delphi surveys and complex models, there is a lot of information and data. One should take in account how to keep all the information useful and manageable.

IT Systems: carrying the weight

Scenarios may be built by various methods, but given the necessity of quantitative results, the Delphi approach is very promising, since it is possible to directly ask experts to estimate the probabilities of each element of the scenarios being built. Traditionally, these scenarios building efforts are supported by long, and in most cases extenuating.

However, as exposed above, the Delphi has some efficiency issues, especially regarding the experts' engagement and the information management. In order to improve the total efficiency of the process and the engagement of the participants, a new tool has been proposed by some experts (Gordon, Pease, 2006).

This tool, called Real-Time Delphi (RTD), resembles the traditional Delphi, but by using a web-based environment it allows a real-time feedback, which drives the consensus in a more streamlined way. The features given by the web environment also allows a more active interaction between the exercise managers and the respondents.

Once the model of the system is built – with the variables and events determined – it is prepared the Delphi consult. In the case described in this paper, it was prepared a consult based on a web site running on the firms intranet system (BALAGUER, BEZERRA AND SILVA, 2008). The site is programmed using the Cold Fusion language and the databases use SQL. The intention is to make a friendly interface in order to keep the attention of the experts while they are attending the consult.

The first phase of the Delphi asked the experts about the probability of occurrence of the events, the importance of the events to the system and the self-evaluation of the experts concerning the theme of the event (Figure 4).

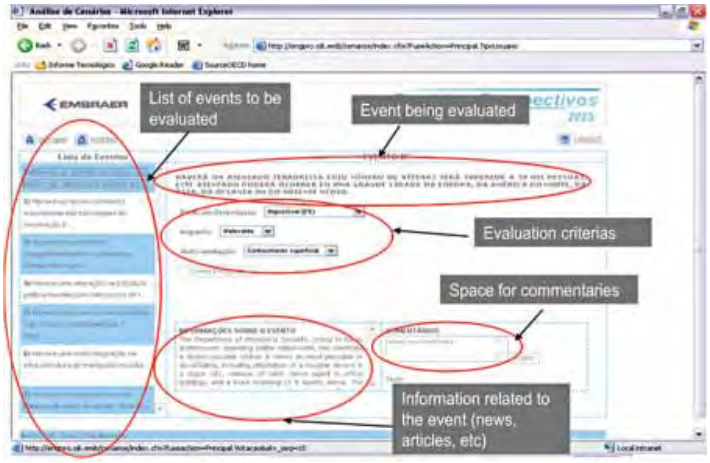


Figure 4 - Detailed view of the page (phase 1)

Source: (BALAGUER, BEZERRA AND SILVA, 2008)

For the second phase of the Delphi, the experts where asked to evaluated the cross influence of the occurrence of each event on all others events. The intention was to construct a cross-impact matrix. To avoid the dry aspect of a matrix, the web page presented to the experts a more soft view of the correlations (Figure 5).

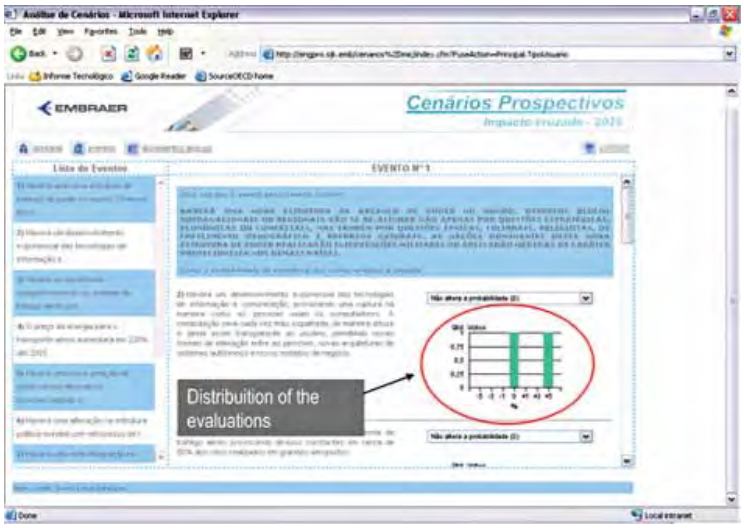


Figure 5 - Detailed view of the page (phase 2)

Source: (BALAGUER, BEZERRA AND SILVA, 2008)

In both phases, once the experts voted, a graph with the distribution of all the answers was showed. The experts had the choice to change their vote if they considered a new aspect and also had a special space to make comments about their votes (Figure 6).

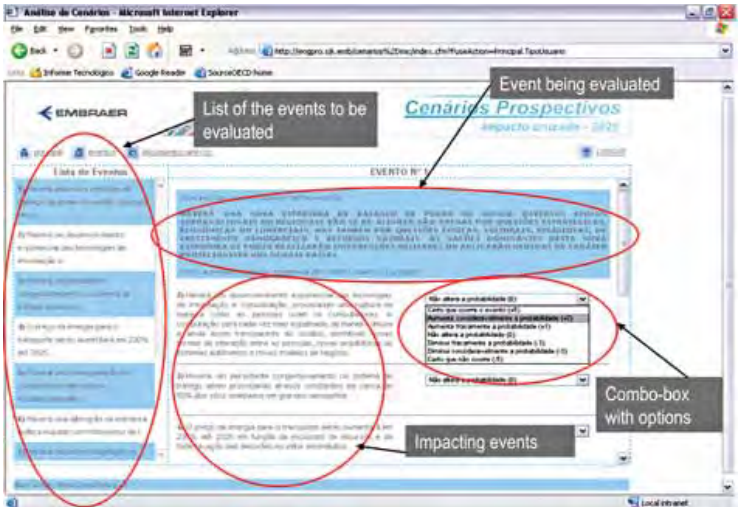


Figure 6 - Votes distribution chart

Source: (BALAGUER, BEZERRA AND SILVA, 2008)

The first phase of the Delphi had a participation effectiveness of 62%. In the previous scenario exercise – where paper forms where used – the participation effectiveness was 46%. The second phase of the Delphi had a participation effectiveness of 43%. In the previous scenario exercise – where paper forms where used – the participation effectiveness was 33%.

Moreover the considerable increase in participation, some other benefits where observed. The most interesting one was the strategic discussion that occurred on the Delphi web-site. Motivated by the answers concerning the events, the experts found a good place to share their knowledge on the subjects, and even discuss how the firm might be positioned in the case of occurrence of some of the events. It is important to observe also that a considerable convergence of the expert's opinions was achieved.

Conclusion: some thoughts and lessons

Thought the experiences described in this paper some insights were gained. These insights provide useful lessons to practitioners when applying IT systems in prospective activities. The lessons are:

1) IT systems are not panaceas: As exhibited above, IT systems are very important to enhance the power of some prospective processes and to streamline some perilous activities. However, IT systems are not a solution in itself. One must be watchful when applying such king of solution, because the IT system must be customized to the process and not the other way around.
2) Choose your battles – do what matters and makes sense: When starting a prospective activity inside an organization – or applying a new tool such as an IT system – it is essential to adjust the scope to a low expectation level. One must take in account a maturation perspective, where the learning-by-doing process is basilar to achieving full maturity. That implies that new process, running for the first time, must not be used in very critical decision making.
3) Think a lot about your processes at first place: It is essential to invest a lot of time in design the processes, adjusting them to the institutional culture and calibrating them to the decision-making routines of the institution. Prospective processes are very important to achieve a robust decision-making, but one must observe the decision-makers and decode how they make their decision: which are the information used, how is the timing and how the information is organized. Only with this perspective it is possible to design an effective prospective process intended to support the decision-making.

4) Carefully chose your weapon, time and place for action: Once the prospective processes are defined, it is important to properly read the institutional environment and decide when and how it will be used in the decision-making process. This is especially important when using IT system to engage many people from the institution in the process.

5) Listen to the critics, but keep your vision and don't stop – don't be afraid to be wrong sometimes: No process is perfect and not everybody agrees with the way decision-supporting activities are being conducted. It is important to understand the honest objections, because those are the source of very critical improvements. However, when dealing with the level of uncertainty and complexity intrinsic to the prospective activity, it is essential to keep a deep sense of purpose, and very clear vision of what one want to achieve.

6) Stakeholders are very important, but at the very end, it is all about making your boss felling easy: It is essential to everybody involved in the process – but especially the decision-maker – understand that the future is, basically, unpredictable. It means that the only success criterion is the usefulness of the information generated to the decision-maker. The critical success factor – and, unfortunately, one of the most underrated – of the prospective activity is the expectations management. The proximity with the decision-maker, and a deep understanding of what is success to him, shall be a golden rule to the prospective manager.

References

ASCHER, W, 1978 apud MILLETT, S.M.; HONTON, E.J. *A manager's guide to technology forecasting and strategy analysis methods*. Columbus, OH: Battelle Press, 99 p. 1991.

BALAGUER, D. L.; BEZERRA, J.E.C.; SILVA, R.C. Real-time delphi as a tool for scenarios building: a case report on an aeronautical firm. *INTERNATIONAL SEVILLE SEMINAR ON FUTURE-ORIENTED TECHNOLOGY ANALYSIS (FTA): IMPACTS ON POLICY AND DECISION MAKING*, 3., Seville, 2008. Proceedings… 2008.

BALAGUER, D. et al. Technological prospective as a driver for innovation in high- compexity products. In: MACK, T.C. *Hopes and Visions for the 21st Century*. Bethesda, MD: World Future Society, 2007. p. 101-113.

BALAGUER, D. *E o futuro, de que é feito afinal? Acerca de uma hipótese sobre a natureza do futuro e de uma proposta para prospectiva tecnológica*. 2005. 106 f. Tese (Mestrado) - Instituto Tecnológico de Aeronáutica, São José dos Campos, 2005.

COATES, J.F. Foresight in Federal Government Policy Making. *Futures Research Quarterly*, v. 1, p. 29-53, 1985.

COMMISSION ON THE FUTURE OF THE UNITED STATES AEROSPACE INDUSTRY. *Final Report of the Commission on the Future of the United States Aerospace Industry* (2002). Disponível em: <*www.aerospacecommission.gov*>. Acesso em: 05 Jan, 2004.

FAHEY, L.; RANDALL, R.M. What is scenario Learning? In: FAHEY, L.; RANDALL, R. M, eds. *Learning from the future: competitive foresight scenarios*. New York: John Wiley & Sons, Inc, 1998.

GODET, M. From forecasting to La Prospective: a new way of looking at futures. *Journal of Forecasting*, v.1, p.293-301, Jul-Sep 1982.

_____. *A caixa de ferramentas da prospectiva estratégica -problemas e métodos*. 1999. Disponível em: <*http://www.cnam.fr/lipsor/lips/conferences/data/bo-lips-po.pdf*.>

_____. *The crisis in forecasting and the emergence of the prospective approach*. New York: Unitar, 1979 (Pergamon Policy Studies) apud MASINI, E.B. Why future studies? London: Grey Seal, 1993. 144 p.

GORDON, T.; PEASE, A. RT delphi: an efficient, round-less, almost real time delphi method. *Technological Forecasting and Social Change*, v. 73, 2006, p. 321-333.

JANTSCH, E. *Technological forecasting in perspective: a framework for technological forecasting, its techniques and organisation*. Paris: OECD, 1967. 401p.

KASH, D. E.; RYCROFT, R. Emerging patterns of complex technological innovation. *Technological Forecasting & Social Change*, v. 69, 2002. P. 581–606.

MARTINO, J.P. *Technological forecasting for decision making*. New York: Elsevier Science Publishing Co. Inc., 1983. 385 p.

MASINI, E.B. *Why Future Studies?* London: Grey Seal, 1993. 144 p.

McHALE, J.; McHALE, M.C. An assessment of futures studies world wide. Futures, v. 8, n. 2, 1976 apud MASINI, E.B. *Why Future Studies?* London: Grey Seal, 1993. 144 p.

MILLETT, S. M.; HONTON, E.J. *A Manager's guide to technology forecasting and strategy analysis methods*. Columbus, OH: Battelle Press, 1991. 99 p.

MOWERY, D.; ROSENBERG, N. Mudança técnica na indústria de aeronaves comerciais, 1925-1975. In: ROSENBERG, N. *Por dentro da caixa preta*. Campinas, SP: Editora da Unicamp, 2006. p 245-266.

NELSON, R.R.; WINTER, N.G. *Uma teoria evolucionária da mudança econômica*. Campinas, SP: Editora da Unicamp, 2006. 631 p.

PHILLIPS, A. *Technology and market structure: a study of the aircraft industry*. Lexington, Massachusetts: Health Lexington Books; Santa Monica, California: Rand Corp., 1971. 233 p.

_____. Patents, Potential Competition, and Technical Progress. *American Economic Review*, May 1966. p. 304.

SCHUMPETER, J.A. *Teoria do Desenvolvimento Econômico: uma investigação sobre lucros, capital, crédito, juro e o ciclo econômico*. São Paulo: Abril Cultural, 1982.

SCHWARTZ, P. *A arte da visão de longo prazo*. São Paulo: Ed. Nova Cultura, 2000.

SHERRY, L.; SARSFIELD, L. *Redirecting R&D in the commercial aircraft supply chain*. Rand Issue Paper, Mimeo, 2002.

ZACKIEWICZ, M.; SALLES-FILHO, S. Technological foresight - um instrumento para política científica e tecnológica. *Parcerias Estratégicas*, n. 10, p.144- 162, março de 2001.

Anexxes

Final Program

Foresight International Seminar: from theory to practice

Brasilia, December 16th and 17 th, 2010

Objectives

The seminar intends to facilitate the sharing of experiences on the use of foresight methods and tools aiming at informing decision-making processes at both private and government levels.

Location: SCN Q. 2, Bloco A, Corporate Financial Center, 1st floor, Espaço Elo, Brasília – DF

Dates: December 16 to 17, 2010

Target audience:

This seminar will congregate selected invitees coming from Brazil and countries abroad with ample expertise in carrying out foresight exercises aiming at informing decision making processes in the field of science, technology and innovation. CGEE expects that around 60 people will attend the seminar. The working language will be English.

Seminar format:

The seminar is organized in the form of four thematic panels, as shown below::

1) Language and communication styles required to address the interests and expectations of the client and involved stakeholders;
2) The application of methods and tools to break mindsets and bring new perceptions to the table;
3) Main aspects considering in designing foresight activities;
4) The application of information and knowledge management tools.

December 16th, 2010

09:00 Opening

09:30 – 12:30 Panel 01:

Language and communication styles required to address the interests and expectations of the client and involved stakeholders

Chair
Marcio de Miranda Santos | CGEE Executive Director

Speakers
Richard David Hames | Executive Director of the Asian Foresight Institute
Lelio Fellows Filho | CGEE Adviser
Richard Silberglitt | RAND Corporation, Senior Physical Scientist

12:30 – 14:30 Lunch

14:30 – 17:30 Panel 02:

The application of methods and tools to break mindsets and bring new perceptions to the table

Chair
Rosa Alegria | Vice President of "Núcleo de Estudos do Futuro" Catholic University, São Paulo

Speakers
Fernando Ortega San Martín | Foresight and Technology Innovation Director Concytec
Jack Smith | Adjunct Professor, Telfer School of Management, University of Ottawa
Ron Johnston | Executive Director of the Australian Centre for Innovation (ACIIC)

December 17th, 2010

09:00 – 12:30 Panel 03

Main aspects considering in designing foresight activities

Chair
Claudio Chauke Nehme | CGEE Adviser

Speakers
Bryan Boyer | Design Lead, SITRA, Finland
Cristiano Cagnin | European Commission, JRC-IPTS

12:30 – 14:00 Lunch

14:30 – 18:00 Panel 04

The application of information and knowledge management tools in the process of developing foresight activities

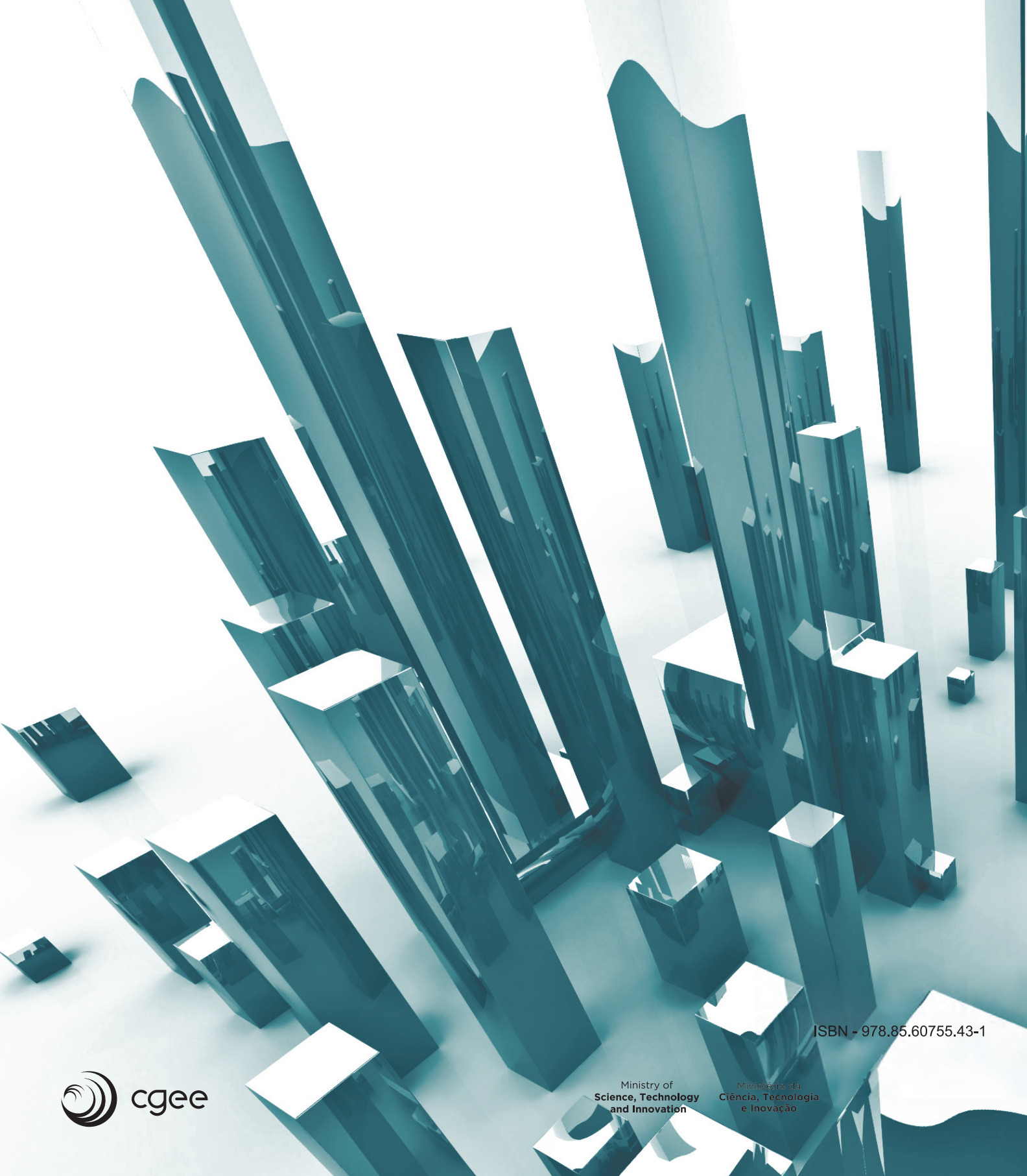
Chair
Sergio Luiz Monteiro Salles Filho | Professor of DPCT and GEOPI Coordinator - UNICAMP

Speakers
Denis L. Balaguer | Chief Technology Adviser, Embraer
Gilda Massari Coelho | CGEE Adviser
Howard Rasheed | CEO and Founder, Institute for Innovation, Inc., and Associate Professor at University of North Carolina at Wilmington

18:00 Closing remarks

Figure list

Table list



ISBN - 978.85.60755.43-1

cgee

Ministry of
Science, Technology
and Innovation

Ministério da
Ciência, Tecnologia
e Inovação