Future Studies, Foresight and Scenarios as basis for better strategic decisions

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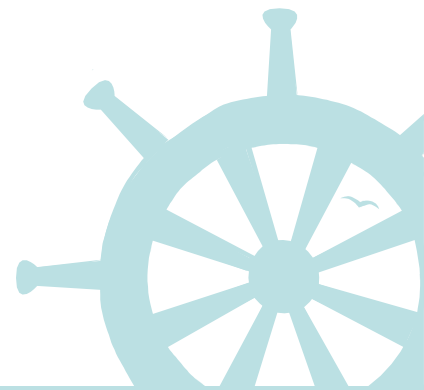
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Summary:

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After an introduction to the field of foresight and a review of the development of foresight and scenario related techniques, the paper describes a methodology for building scenarios. This methodology is articulated around the identification and analysis of key drivers of change with high impact on the future, hence on the strategic decisions to be made today.

Keywords: Foresight, scenario-building, scenario-planning, future studies

Classification: Open

Future Studies, Foresight and Scenarios as basis for better strategic decisions

" Scenarios are the most powerful vehicles I know for challenging our "mental models" about the world, and lifting the blinders that limits our creativity and resourcefulness",

P. Schwartz, The Art of the Long View, 1991.

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1. Abstract

Studying the future starts by accepting its uncertainties and convert them into sources of new ideas and opportunities. The future is not predictable, and strategies that are based on an anticipation of a future as a prolongation of past development are nothing more than business-as-usual and unlikely to really foster innovation.

To build successful strategies that guarantee sustained competitive advantage, a firm must be able to handle change and accept that tomorrow may be radically different from today. Open-mindedness and out-of-the-box thinking are essential to make an organization able to adapt and reshape according to eventual changes in its surrounding environment.

It is precisely for this for this dealing with uncertainties and changes related to the future that foresight and scenario-planning are powerful tools. Scenarios are defined as structurally different stories about how the future might develop. By using scenarios companies are able to establish a broader framework for strategic planning and they are provided with new ways of thinking about and planning for the future. Building visions of the future does not mean predict it, but try to imagine what could happen, for better preparing and answering the question "what should we do if this would happen?"

After an introduction to the field of foresight and a review of the development of foresight and scenario related techniques, the present paper describes a methodology for building scenarios. This methodology is articulated around the identification and analysis of key drivers of change with high impact on the future, hence on the strategic decisions to be made today.

2. Introduction: Foresight – Evolution of a Field

2.1 History

Most of the roots of the field foresight can be found in the USA, where the application of foresight techniques in the defense industry, and thereafter in the energy industry, took off in the 50s-60s. Among the pioneers of foresight, one finds the RAND Corporation and the Hudson Institute (founded by H. Kahn).

Over the years, governments and corporations started to conduct foresight studies in order to better plan technology-related investments (Reger, 2001).

In the 1970s, Japan engaged actively in technology foresight projects mostly based on five-year Delphi surveys (Brandes, 2009). Western Europe started foresight activities in the 90s based on Delphis surveys, mainly for policy development related to science and technology. Until then the focus had been primarily on forecasting rather than exploring future opportunities.

The field of foresight has developed in parallel with the growing awareness of the need for future orientation and recognition of uncertainties about the future, both at corporate and governmental level.

The figure below illustrates how foresight studies have been evolving since the 60s, finding root in the military sector, then spreading to corporate sector and society at large, and originally focusing on the development of basic sciences, then technology, and more recently on innovations (encompassing research and technology development).
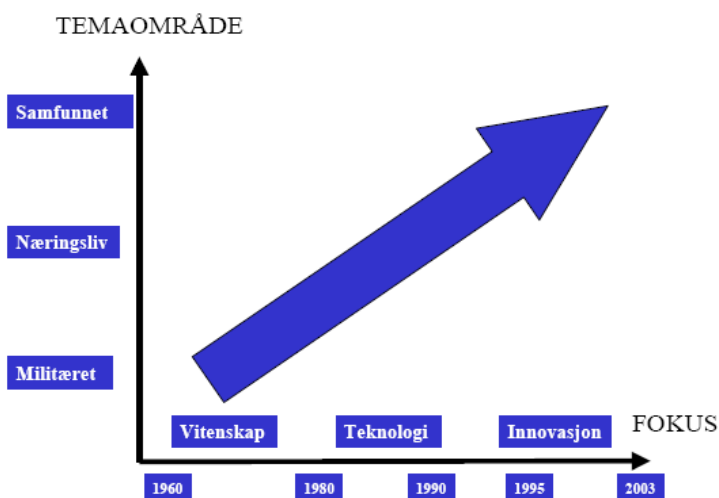
Figure 1: 40 years of foresight studies (Source: Fagerheim, 2003, adapted from Wagner, RAND Europe, 2003).

2.2 Definition

Foresight is about establishing a vision/sight of the future. Foresight goes in pair with future studies, and is closely associated with scenarios-building. Viewing foresight as a process, the Institute for Prospective Technological Studies[1] defines foresight as "*a*

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[1] IPTS, http://forlearn.jrc.ec.europa.eu/index.htm, is one of the scientific institutes of the European Commission's Joint Research Centre, JRC

systematic, participatory, future-intelligence-gathering and medium-to-long-term vision-building process aimed at present-day decisions and mobilising joint actions" (IPTS[1]).

In an extensive analysis of foresight-related projects[2], Fagerheim (2003) explored this definition more in details, looking at six main core elements of foresight:

1. What characterizes foresight in the **systematic** approach to future uncertainties ensured by the use of specific methods such as scenario-building.
2. Further, the **engagement** of various stakeholders is crucial for the pertinence of the foresight's outcome.
3. The quality of the foresight will then be determined by the quality of **information and knowledge** collected for the project, and helping to better apprehend the future through identification of trends and drivers.
4. Foresight projects typically operate with a **medium to long-term perspective**.
5. Foresight studies support strategy development by helping establish common **mental maps and visions**.
6. Finally, the outcome of a foresight project must be **relevant for decision-making** and therefore must look at elements in the future that are believed to have an impact on future activity.

2.3 Foresight in practice

The purpose of a foresight project is as much for helping today's decision-making as it is for creating awareness about tomorrow's challenges and opportunities.

Most of foresight projects regard national matters, either society- or industry focused, but individual companies also work with foresight for better apprehending the future and developing better strategies.

According RAND Europe (Fagerheim, 2003), there are four principal methodological approaches to foresight:

• **Scenarios**, or the establishment of images of the future.
• **Delphi surveys** - opinion collection mainly based on expert contribution.
• **Panels** - group discussion engaging both experts and non-experts.
• **Games and other methods** dedicated to brainstorming, creative thinking and generation of new ideas.

The report "MIND THE GAP" from the project CREATE (Fagerheim, 2003) gives an excellent overview of foresight activities in Norway. Most foresight-related projects in Norway are based on the scenario-method, and partially on the Delphi-method and other kinds of creative thinking activities. Many different groups enjoy the use of foresight studies, some more actively or systematically than others. SINTEF has been engaged in foresight for many years, and the group's work around the field is documented in Neerland (2009), which testifies of the broad scope and numerous techniques used over the years.

When it comes to scenario planning, the group ECON[3] is one of the most substantial references in Norway. More recently, the consulting company Foresight Norge has become

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[2] Work published in 2003 in a report entitled MIND THE GAP, and conducted in the context of the project "CREATE", The Norwegian Foresight and Dialogue Project on Priorities in Science and Innovation Policy.
[3] www.econ.no

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a significant actor in the field of foresight and scenario-driven strategies, Established in the 90s, they offer a broad spectrum of services for regional development, innovation, and business and strategy development.

2.4 Foresight and Future Studies at MARINTEK

At MARINTEK, foresight is regarded as a central element of future studies and is defined as "a vision of the future".

MARINTEK conceives a foresight exercise as a three-step approach, described in Figure 2, in which scenarios play a key role.
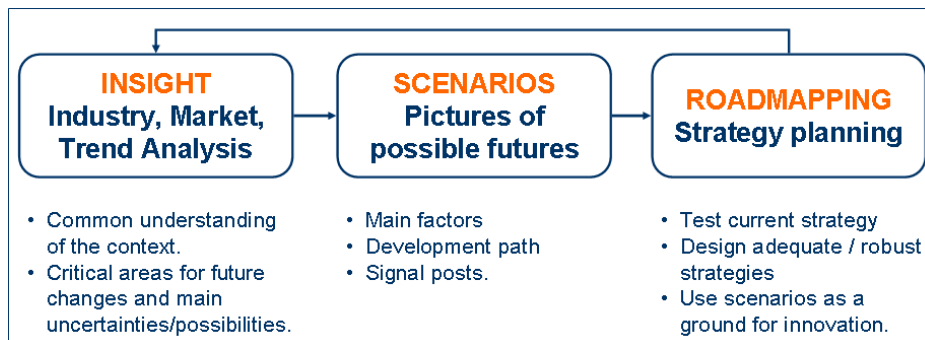

Figure 2: Foresight at MARINTEK

1. Insight – establish common mental maps

Before engaging in a scenario process, it is important to establish a common understanding of the context under investigation. This necessary insight is built through various techniques, depending on the previous degree on knowledge on the topic under study. Industry and market analyses as well as trend analysis are typical elements of preparatory work to be conducted in order to pertinently identify areas for future possible changes and main associated uncertainties and possibilities.

This step is an important building block of a foresight exercise, and its added-value lies in the mapping of the context under study, the present contingencies and future uncertainties.

2. Scenarios – alternative images of possible futures

At the core of a foresight exercise, scenario-building serves to highlight possible futures which are believed to be relevant for today's decisions. The principle of scenario building, as a qualitative method (described later in chapter 4), is founded on the identification of future main drivers of change which, once analyzed and configured in distinct cause-effect systems, enable the drawing of alternative scenarios and signal-posts that will serve as open-minders to enlighten decision-makers and give them a broader view of future uncertainties related to their field/business.

3. Roadmapping- strategy planning

"Necessity is nothing more than the result of a lack of foresight." (de Jouvenel, 2000:40). Therefore, foresight help building a vision of a future context to be taken into account in developing today's strategies. Hence the importance of developing scenarios that are meaningful and logically constructed, and based on cause-effect relations that can be analyzed backward to help adjusting today's decisions.

Either as an open-minder or a system for idea-generation, scenario-building processes are used for strategy planning and innovation. Scenarios provide alternative visions of the future which serve as test ground for planned/existing strategies, or for developing new ones and fostering innovative ideas.

New products, new markets, new policies cannot be developed based on today's assumptions and contingencies. They must recognize that tomorrow is uncertain and that a robust roadmap is the one that take into consideration potential implications of different alternative futures.

Finally, whereas foresight may be useful for one-time problem solving, the real added-value in a foresight exercise is its utility overtime, the fact that foresight can and should be updated regularly and mental-maps re-configured according to the changing environment. A foresight exercise does not stop after road-mapping is effectuated, but the loop goes back to reestablishing insight, so that new or updated scenarios can be generated, and so on.

3. Scenario – a powerful method for foresight and strategic planning

3.1 Definition and purpose

The fundamental of a future scenario is that it aims at treating UNCERTAINTY.

Scenarios are *structurally different stories about how the future might develop*, that are believed to have an impact on the field/business on focus. They are presented in a way that triggers imagination and reflection, thus creating visions of the future. Scenarios challenge underlying assumptions and established truths; they may be applied for strategic development and innovation purposes at company level, in context specific planning, or at country or industry level.

The essential condition for scenarios to be truly useful is that they must be plausible, internally consistent, i.e. logically assembled, and relevant for today's decision makers.

The figure below illustrates scenario-building as a projection into the future, showing a large scope of uncertainty compared to today, and how distinct scenarios embrace these uncertainties into complete pictures of possible alternative futures.
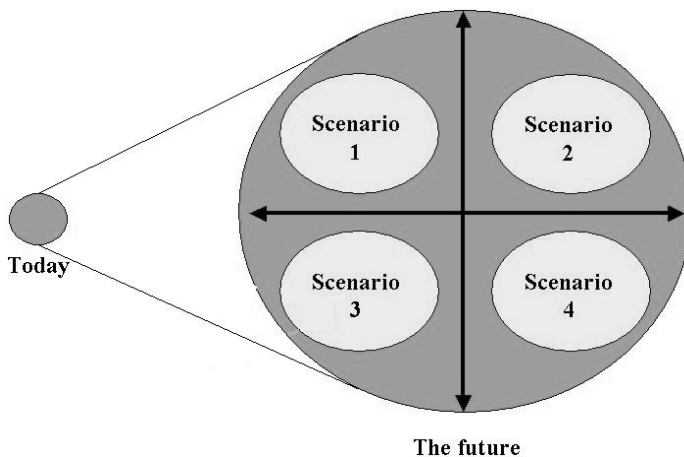

Figure 3: Scenario as a projection into the future

3.2 Benefit of scenario-planning

The future has always been fascinating, and attempts to control it are not new. Still, most of the time, even the strongest beliefs at one point in time have turned out to be completely wrong in a later future.

The following quotes illustrate this difficulty of predicting the future:

- *"There is no reason for an individual to have a computer at home"*, Ken Olsen, Chairman of Digital Equipment Corporation (DEC), 1978.
- *"I have traveled the length and breadth of this country and talked to the best people, and I can assure you that data processing is a fad that won't last out this year"*, Business book editor of Prentice Hall, 1957.
- *"Everything that can be invented has been invented"*, Charles H Duell, Commissioner, US Office of Patents, 1899.
- *"Airplanes are interesting toys, but of no military value"*, Marsall Ferdinand Foch, 1911.

- *"Worldwide demand for cars will never exceed one million, primarily because of a limitation in the number of available chauffeurs"*, a research report to Mercedes-Benz, 1901

These quotes highlight the importance of understanding the context in which one operates and accepting that this environment may/will completely change in the future.

As defined in the previous chapter, scenarios challenges underlying assumptions and established truths. By developing and exploring scenarios we are searching for trends, events or driving forces that may lead to a future radically different from the situation today. In this way, we are able to take a pro-active role by asking questions such as "**what** would we do **if** this or that should happen?" rather than leaning back or looking at a crystal ball and asking questions such as "what **will** happen to us?". Such an attitude enables out-of-the-box thinking.

When it comes to the motivation for using scenario-planning, companies report a wide range of benefits summarized in three main points (Kroneberg et al., 2001):

1. New ways of apprehending the future:
   - Removal of blinders (out-of-the-box thinking and beyond a "most likely" future).
   - Exploration of new ideas and opportunities.
   - Identification and understanding of key future drivers of change.

2. A test-bed for strategies:
   - Identification of robust goals and strategies according to alternative scenarios.

3. "A map of the future":
   - A common mental framework for discussing future issues.
   - Faster response to a changing environment.

As pertinently underlined by Van Der Heijden and Burt, "With uncertainty on the table the focus shifts from 'the best strategy' to 'the best strategy process' " (2003: 1020). Indeed, scenarios help create more robust strategies, they generate innovative solutions and products, but most importantly a scenario process enhances the change readiness or dynamic capabilities of an organization, meaning its ability to handle change and multiple forces of change simultaneously.

Change Readiness can be defined as the immediate or the long term response to enforced changes in the business environment. It expresses a company/organization's flexibility or responsiveness towards current and future challenges, often related to change in business environment, and consists of three main dimensions:

- Insight: knowledge and complete understanding of surrounding changing environment.
- Culture: attitude towards change and creative thinking.
- Structure: organizational configuration for acquiring critical insight and transform it into decision.

These three dimensions of Change Readiness also determine the ability of an organization to create competitive advantage, through a continuous process of "sensing", i.e. analysing and understanding the environmental and market opportunities, and "seizing", i.e. reconfiguring the organization accordingly. Dynamic capability or Change Readiness as basis for competitive advantage is well summarized by Teece et al.: "Winners in the global marketplace have been firms that can demonstrate timely responsiveness and rapid and

flexible product innovation, coupled with the management capability to effectively coordinate and redeploy internal and external competences." (Teece et al., 1997:15)
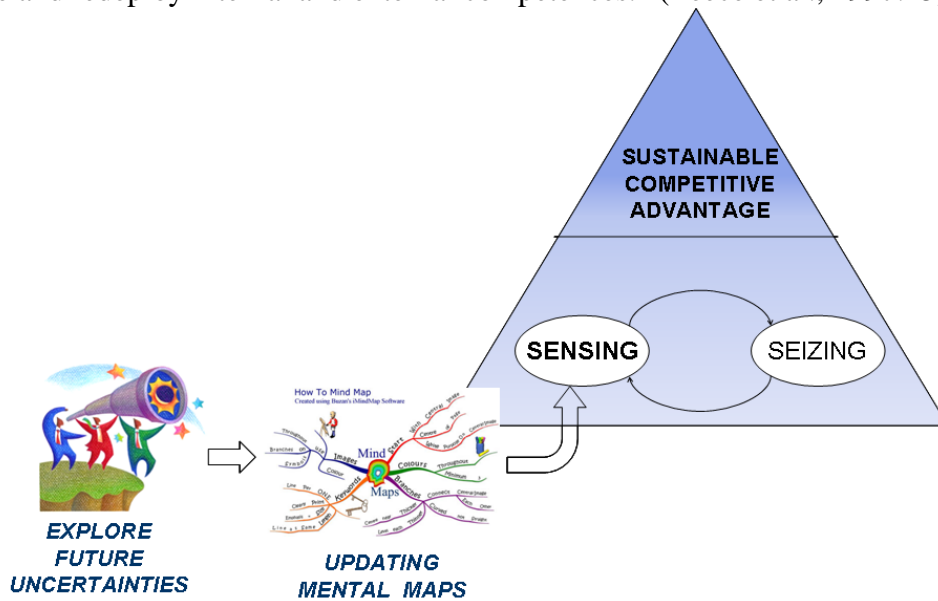

Figure 4: Benefit of Scenarios from a Dynamic Capability perspective

The figure above illustrates this foundation for sustainable competitive advantage and shows how scenarios help creating change readiness by exploring future uncertainties and building new mental maps.

3.3 Evolution of scenario-planning

The present section gives a brief overview of the history of use of scenarios and introduces the main schools of scenario-building.

3.3.1 History of use of scenarios

The recognition of scenarios as a fruit of imagination used in order to create visions of possible new realities is not new. Early philosophers like Plato, but also famous futurists like T. More and G. Orwell, have given proof of the value-added of building visions of the future (Bradfield et al., 2005).

Following the same development as foresight, scenarios used for contingency planning can be trace back to the Second World War, when they were used for US military purpose (Schwartz, 1991; Kroneberg, 2000). In the 70s, the use of scenarios for corporate purpose was initiated, supported by academics and researchers on one side, and practitioners on the other side.

The acknowledgment of scenarios as tools for strategy planning was intensified when proof of their relevance was put forward during the crisis following the oil price shock in 1973 (Mercer, 1995; Kroneberg, 2000). In particular, companies like Royal Dutch Shell and General Electric demonstrated the value of scenarios for business purposes, although Shell's activities around the topic have been more documented (Bradfield et al., 2005).

This was followed by an increasing use of scenario in industries, which, thanks to an increasing documentation of successful experiences[4], resulted in a wider use of this decision-support tool world-wide, for both social and political interests (Bradfield et al., 2005).

This past evolution is summarized in figure 3.

Figure 5: Evolution of scenario planning

3.3.2 Main schools of scenario-planning

Bradfield et al. (2005) gives an excellent overview of the development of the field of scenario in "the origins and evolution of scenario techniques in long range business planning", with particular focus on two main geographical centers: USA and France. These have played a key role in the development of the field and its various techniques. More striking, these two centers have developed almost simultaneously.

The **USA centre**, or Anglo-American School of Scenario planning, originates from the work of Kahn and the RAND Corporation, and was further developed through the famous Stanford Research Institute, as well as through the active work of Shell and GE within scenario planning as permanent strategy. This evolution of the USA centre gave birth to two main schools:

- The *intuitive-logic school*, in which scenarios planning is viewed as a framework for thinking about the future. This *intuitive methodology* is often associated with "the Shell approach", it is qualitative by nature and a rather flexible methodology, highlighting the importance of the learning process.

- The *probabilistic-modified-trends school*, which includes trend-impact analysis and cross-impact analysis. These methods are primarily probabilistic forecasting, but are used to generate several alternative futures and can be complemented with judgements and other more qualitative assessment.

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[4] In the database EBSCO*host* Electronic Journals Service, as of December 2009, 2620 articles with "scenario" in the title were published since 1965, of which 1115 in academic journals. The period 2000-2009 accounts for 75% of all the publications.

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The **French Centre** finds its roots in the work of Berger, who created a scenario approach to long-term planning called "prospective thinking" (La Prostective). Recognizing the failure of traditional forecasting approaches, La Prospective aimed at developing normative scenarios, consciously modeled, for providing "a guiding vision to policy makers and the nation" (Bradfield et al., 2005:802). The French centre evolved further, through the creation of the "Futuribles Group", created by de Jouvenel, wishing that futurists could "act as catalysts in articulating idealistic images of what the future could be like" (2005:802). La Prospective then began to develop a mathematical and computer-based probabilistic approach to scenario (lead by Godet). This, in addition to the traditional normative approach of La Prospective, positions the centre somewhere between probabilistic-modified-trend methodologies and intuitive logic, on a axis going from purely qualitative approach to purely quantitative ones.

This parallel evolution of the USA and the French Centers is shown in the following figure, as well as the position of the 3 main schools.
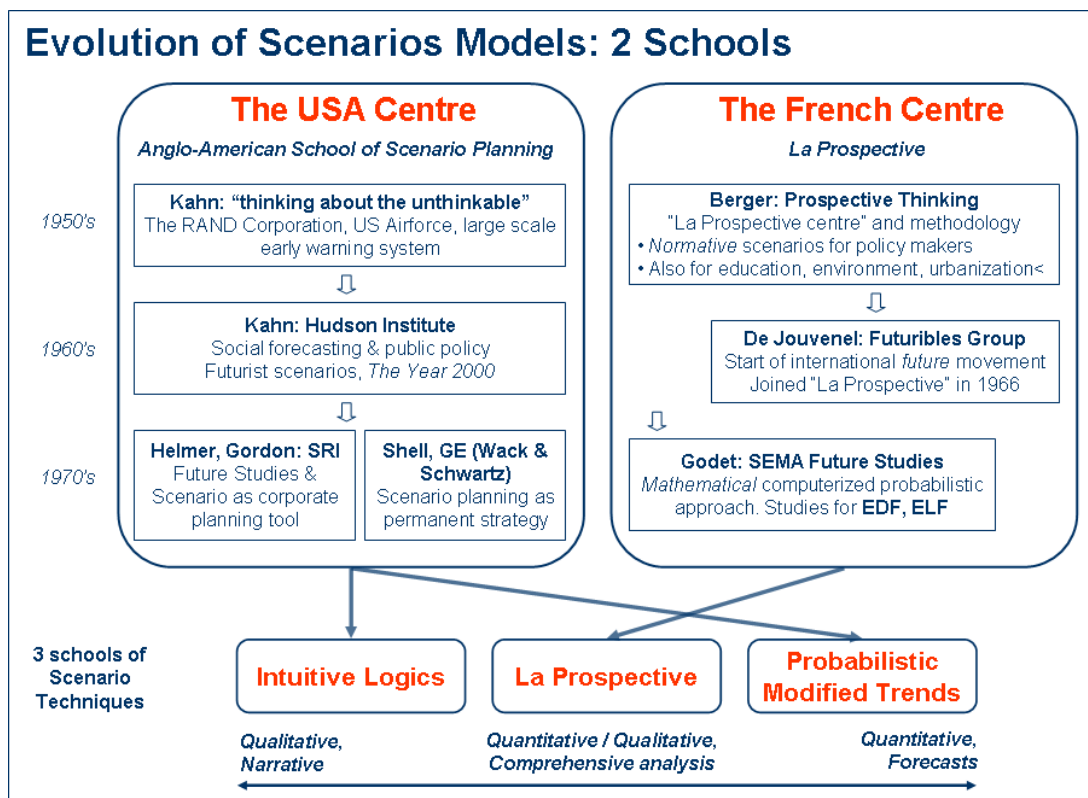

Figure 6: Evolution of scenario techniques at the USA and the French Centers (based on Bradfield et al., 2005).

3.4 Scenario building and planning in practice

Scenarios are recognized by many as a powerful tool to apprehend the future. Instead of planning based on linear forecasts and today's premises, future-oriented strategists see the benefit of envisioning alternatives futures in order to prepare adequately.

Today, scenario techniques are used by various groups for various purposes (see Figure 7). Scenarios for strategy-planning are typically used by businesses, but also for crisis management in the defense sector. Scenarios are also used by scientists for illustrating the possible evolution of complex systems. They are used by policy makers for establishing a

vision of the future that shall help policy implementation. Finally, scenarios are used in a more pedagogical way, by institutes teaching and promoting the use of future studies.

Figure 7: Areas of application of scenarios (based on Bradfield et al., 2005)

In practice, many organizations have been using scenarios for their own strategy development or for enlightening others. As stated earlier, one of the most famous practitioners, with more than 30 years of experience, is the Royal Dutch Shell, using scenario-planning both as a strategic tool and for guiding other stakeholders. Shell regularly publishes global scenarios focusing on the energy sector[5], and uses scenario to strengthen innovation:

> "*Good scenarios are ones that explore the possible, not just the probable – providing a relevant challenge to the conventional wisdom of their users, and helping them prepare for the major changes ahead. They will provide a useful context for debate, leading to better policy and strategy, and a shared understanding of, and commitment to actions*" (Shell).

Other famous users of scenarios include: the RAND Corporation (introduced earlier), one of the founder of foresight studies; IHS Global Insight, a global leader in economic analysis and market intelligence; ECON, with 20 years of experience in scenario building and other foresight techniques.

When it comes to specialists in future studies, these include many centers around the world, such as CIFS Denmark[6], CIFS UK[7], the Swedish Institute for Future Studies[8], Futuribles in France[9], the US Institute for the Future[10], the Hawaii Research Center for Futures Studies[11], and The Stanford Center for Foresight and Innovation[12].

Global independent organizations include the World Futures Studies Federation (WFSF[13]), a global NGO founded in the 1960s to encourage and promote the development of futures studies (multiple futures), operating as a global network of practicing futurists -

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[5] http://www.shell.com/home/content/aboutshell/our_strategy/dir_our_strategy.html
[6] www.cifs.dk
[7] www.futurestudies.co.uk/
[8] www.framtidsstudier.se/
[9] www.futuribles.fr/
[10] www.iftf.org/
[11] www.futures.hawaii.edu
[12] http://foresight.stanford.edu/
[13] http://www.wfsf.org/

researchers, teachers, scholars, policy analysts, activists and others. Further, the OECD International Futures Program aims at providing early warnings of emerging issues, and analyzing key long-term drivers[14] to help governments map their strategy.

Based on study on available scenario work, Bradfield et al. (2005) highlighted three types of scenario projects conducted: (1) experience-based scenarios in practices, mostly developed by companies using scenario as a strategy planning tool; (2) empirical studies / concept in use, mostly performed by researchers testing models on real-life cases; and (3) theoretical models developed by researchers for building scenarios, but with limited practicality.

From practitioners sharing their experience to highly theoretical and conceptual models, the multitude source of scenarios reveals a certain degree of confusion in how to use scenarios, even conflicting definitions and methodological ideas.

Still, we believe it is completely understandable/acceptable that scenario-building is approached from very distinct angles. It is important to keep in mind the purpose of using scenarios: to help us envisioning the future and think creatively; therefore different techniques should be welcome.

There are numerous techniques used for developing scenarios, which adequacy depend on the purpose of the scenario-building process. We believe that there are four main categories of scenario building techniques:

- Descriptive: Techniques through which scenarios are developed and described in order to imagine plausible futures for helping organizations adapt to a changing business environment.

- Normative: Techniques aiming at developing one scenario for envisioning a desirable future business environment / state of affairs, and the paths to reach it.

- Quantitative: Techniques such as forecasts and probabilities, mostly based on quantitative data and historical facts.

- Qualitative: Techniques of a generally more intuitive nature, more exploratory and dependant on qualitative knowledge and insights as input to brainstorming and panel discussions.

Although these techniques are not mutually exclusive, they are applied for specific purposes and result in distinct types of scenarios, from story-telling to probability-based graphs, and from out-of-the-box exploratory futures to one specific vision of a targeted future.

The figure 8 is an attempt to classify various types of scenario projects and techniques, according to two main dimensions: the *strategic purpose related to the scenario project* (on the vertical axis) and the *uncertainty related to the scope of the scenario project* (the horizontal axis).

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[14] http://www.oecd.org/department/0,3355,en_2649_33707_1_1_1_1_1,00.html
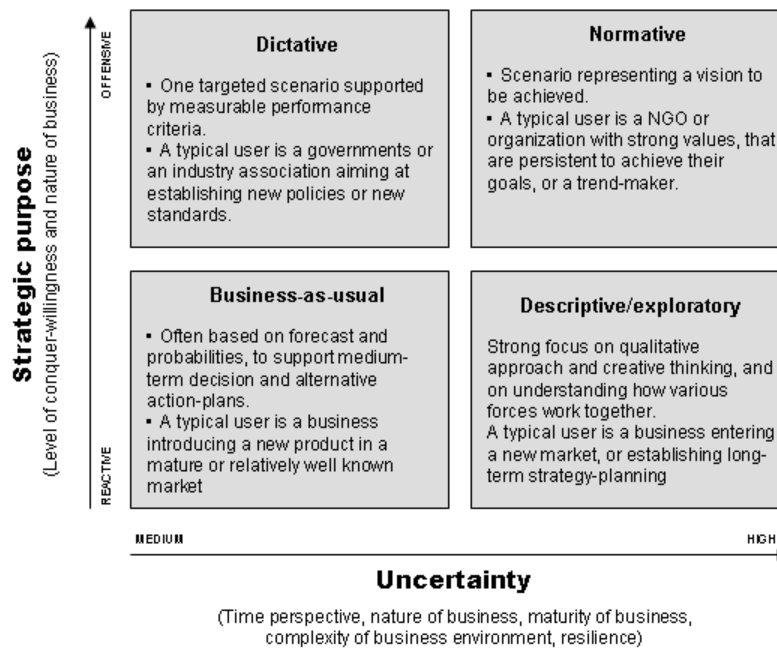
Types & Uses of Scenarios

Figure 8: Mapping of distinct scenario projects.

At MARINTEK, the scenario process does not attempt to forecast one right future, but focuses on how several plausible futures could unfold and how different key forces may contribute to shaping these futures. The focus is on qualitative approaches and long-term perspective. The technique used at MARINTEK is process-oriented, meaning that the team-work, brainstorming and creative thinking sessions are as important as, if not more than, the outcome of the scenario-building process. Scenarios at MARINTEK are exploratory and intuitive, the purpose being to build images and stories of the future. From the figure 8, the down-right box is therefore very representative of what MARINTEK has been mostly concentrating on so far.

Moreover, in order to ensure a certain disciplin in the way scenarios are developed, the approach used is deductive, meaning that a framework describing main key drivers is first established to enable deriving plausible development paths explaining distinct scenarios.

4. Scenario-building: Methodology used at MARINTEK

4.1 10 years of scenario building for the maritime industry at MARINTEK

MARINTEK has worked within the field of foresight for more than 10 years, focusing mostly on scenario-building process and use of scenario for apprehending future challenges in the maritime industry, and to support creative thinking and strategy planning in shipping companies.

Motivation

> *"Scenarios are the most powerful vehicles I know for challenging our 'mental models' about the world and lifting the blinders that limits our creativity and resourcefulness"*, P. Schwartz (1991:XV).

MARINTEK is convinced that exploring the future is a prerequisite for formulating successful strategies, and so by acknowledging that no one knows what tomorrow might bring us. The value lies in the fact that the scenario process does not attempt to forecast the one right future, but focuses on how several possible and plausible futures could unfold and how different key forces may contribute to shaping these futures. MARINTEK believes that the maritime industry could benefit as much from scenario thinking as other industries do, such as the energy sector.

Learning process

MARINTEK has acquired competence within scenario building overtime, starting with a PhD program in 1998-2000 (A. Kroneberg), cooperation and exchange with the Stanford Research Institute, then the application of knowledge and competence in practice, in a series of research and consulting projects.

The most relevant projects using scenario-building performed by MARINTEK include:

- *The role of Statoil in Integrated Supply Chains*, for Statoil (1999)
- *The future of e-ship Management*, for Barber International (2000)
- *Development of a Global Logistics Strategy*, for Wallenius Wilhelmsen Lines (2000[15])
- *Future manning concepts*, for Barber International (2001)
- *Cluster of Norwegian ship yards*: The future of shipbuilding in Norway, for the Møre Maritime Cluster (2002).
- *Global maritime business scenarios*: Short sea shipping scenarios and strategic assessment, for the European Commission (2003)
- *Operational Strategy for Sub-sea Production*, for Statoil (2002/2003)
- *Technology scenarios for 2030*: Assessment of technology strategy, for Statoil (2003).
- *Visionary Concepts for Vessels and Floating Structures* (VISIONS, EU FP6 project): Scenarios for European shortsea shipping and inland transport (2006-2007[16])

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[15] Documented in Kroneberg and Ramberg (2001).

[16] http://www.maritime-visions.net/

- STRATNET: Strategic Implications of network organisation and macroeconomic environment on maritime logistics (2004-2007).

- *European Framework for Safe, Efficient and Environmentally-friendly Ship Operations* (FLAGSHIP, EU FP6 project): 2030 scenarios for the Cruise, Tank, Container, and Ferry sectors (2008[17])

- *The Ocean Space Centre*: scenarios on the future of the global maritime industry towards 2050, for MARINTEK (2009[18])

Our approach

At MARINTEK, the methods and techniques used have evolved over time. Originally the main method was the SRI[19] method, studied and applied by Kroneberg at MARINTEK, and used for developing a scenario-based guideline for innovation (Kroneberg, 1999). This was tested in the WWL case. Later, the methodology resembled more to Schwartz (1991) 8 steps, which describes more in detail the building of scenarios. Later on, MARINTEK updated and adapted the method on a case by case basis. This which resulted in the team sometimes conducting very quick processes, or in the contrary extending some parts of the scenario-process such as the drivers-identification step, in which trend-spotting and monitoring of drivers and their historic evolution was introduced.

Today, the approach used at MARINTEK for scenario-building varies in function of the purpose of the scenario project and the beneficiary of the process (a company or a group of industry stakeholders).

Still the methodology followed is process-oriented, exploratory and intuitive. It is mainly a qualitative method focused on story telling, rather than a software-based method. The main process followed can be either company-centered, or applied to more neutral industry-related challenges. Finally, as explained in chapter 2.4, MARINTEK views scenarios as a essential part of a foresight exercise in which they serve to describe alternative future *contexts* used for defining today's strategies.

4.2 Scenario Methodology

The scenario methodology used at MARINTEK has been adapted from SRI International (former Stanford Research Institute) and further developed to be used in the direction of business and technology innovation. This methodology is primarily qualitatively oriented, and has its roots back to a Think Tank at SRI in the early 1970's. The MARINTEK methodology also encompasses elements of quantitative character – most often in the preliminary phase 1, aimed at establishing insight and industry understanding (which is new compared to the SRI method).

The scenario development and assessment used by MARINTEK today is defined through a five phase process as illustrated in Figure 9, and described in the following chapters.

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[17] See Wijnolst and Wergeland (2008).

[18] http://www.sintef.no/Projectweb/Den-tredje-bolgen

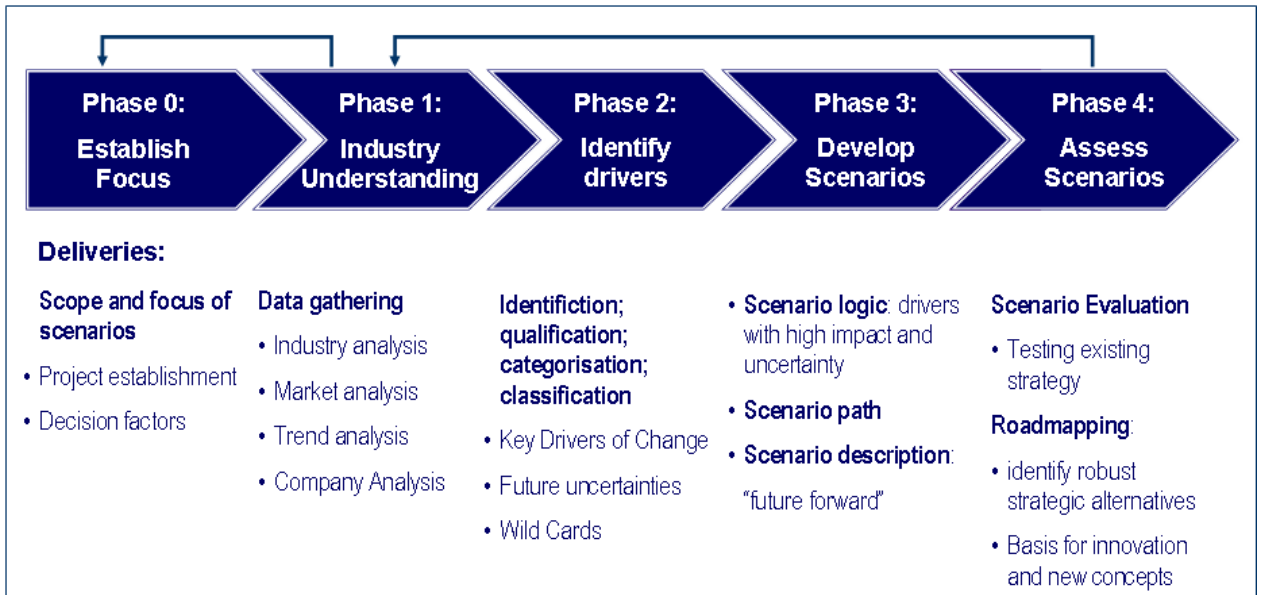[19] Stanford Research Institute (USA), www.sri.com

Figure 9: scenario methodology - MARINTEK

4.2.1 Phase 0: Establish focus

This phase corresponds to the project-definition phase.

As in any project it is vital to establish focus, but **the perspective and strategic nature of future oriented scenarios makes this first scoping and founding process vital**. It is absolutely critical that a scenario project is properly established and has a true "buy in" at management level.

When establishing a scenario project one has to agree on the anticipated output of the scenario process and define clearly the purpose of the exercise. As an example, the scenario project in cooperation with WWL (Kroneberg, 2000) defined the main goals of the process as follows:

- *Explore the need for future logistics management services.*
- *Contribute in the strategy formulation process and in establishing divisional and regional measures and targets with respect to new logistics management services.*
- *Develop a common mental map of the future with respect to new logistics management services.*
- *Evaluate whether scenarios should be used regularly in the WWL strategy planning process.*

The MARINTEK approach further encourages out-of-the-box thinking and enhancing the change readiness of a business (described in chapter 3.2).

Different approaches can be taken for executing a scenario process – from a complete and detailed process to a shorter, more direct approach, depending on the maturity and familiarity of the team with the problem to be solved, the purpose of the scenario project, and the strategy scope.

The figure below draws a parallel between a full blown process for developing scenarios (not be confused with the overall MARINTEK scenario methodology in figure 9) and a short version, pointing out the three central elements in any foresight exercise: (1) defining the strategic questions that the foresight will help answering; (2) identifying key drivers of

future change that will have an impact on the future state of affairs; (3) assess the implication of these drivers on future for defining the actions / decisions to be taken today.

Figure 10: Execution of scenario process, full-blown vs. short process (MARINTEK, 2001)

4.2.2 Phase 1: Insight / Industry understanding

This phase serves to establish common understanding of the problem of focus.

A scenario can be applicable in a number of areas – business-, branch- or country-specific. To ensure a common platform for updating and helping to focus on the problem at stake, **preliminary analyses are essential, such as industry analysis, market analysis, trend analysis, mappings or other combined qualitative and quantitative foundation work**. Deeper understanding, common basis for brainstorming, and mobilization are keys to the success of the scenario process. If the scenario process already is a part of the strategy process this event can for example simply take place as a set of presentations from internal and external resources followed by a discussion or a quality assessment. Otherwise, a common approach is to gather information about past and current trends, industry and market evolution, main challenges and opportunities, and main uncertainties about the future.

On the other side, when the scenario-process is conducted at industry level (not for a specific company), a more academic type of industry analysis could be even more relevant. An example of a maritime industry analysis outline (also presented in Wijnolst and Wergeland, 2008) is summarized below:

Main components	Sub-items	Purpose/Comments
Delimitation	Criteria for segmentation: • Ship size • Geography • Product characteristics • Cross elasticities	A precise definition of the market is necessary, but not always trivial. Sometimes less than perfect delimitations must me made depending on availability of data.
Market history	• Initial innovation • Main companies/persons • Growth rates • Cyclicality • Phases of development	Understand how this industry came into being and how it has developed until the current situation. Innovation-, Demand-, or Supply-driven?

Main players on the supply side	• No of players • Dominating firms • Market leaders • Concentration ratios • Company profitability	Can the firms exert any form of market power? Any firms with over average earnings? If so, why? (size, strategy?)
Structure of demand	• No of players • Dominating firms • Negotiation power	Fragmented or segmented demand side? Contract negotiation relations Customer loyalty/switching costs
Competition and market structure	• Free competition • Monopolistic competition Oligopoly, Monopoly?	What is the extent of the strategic interaction among the players?
Supply and demand balance	• Degree of oversupply • Importance of productivity factors	What is the market situation? A normal or very special market situation? Development of earnings.
Industry attractiveness	Porters five forces or McKinseys 7 factors	What are the main factors determining this industry's attractiveness (if at all attractive)
Critical success factors	Examples: • Marketing, CRM • Financial engineering • Quality of operations • Cost leadership • Strategy • ICT	What must a winner in this industry be good at? Main strategic goals?

Table 1: Generic Industry Analysis for the Maritime Industry.

At the end of phase 1, based on the information gathered and the insight established about the topic on focus, some precisions and/or modifications can be made to the project definition. This is represented in figure 9 by the arrow going back from phase 1 ot phase 0.

4.2.3 Phase 2: Identify driving forces of change

This phase focuses on highlighting the main change drivers that will form the basis of the scenario-building.

In a scenario process one must work hard to avoid the obvious and the established truths. When developing scenarios, one must always strive to **identify and understand the underlying drivers of change**, meaning the main forces that affect the development of an industry, a country, a society, etc. and are likely to play a significant role in how the future will evolve. Although drivers ca be identified through a analysis of secondary data, it is most often done by assembling a set of opinion holders (experts or not), introducing them to a scenario scope (time perspective and targeted field of study / research question) and asking them to identify the forces that they believe will drive the fundamental changes in this field in the future. When scenario-planning is used at company-level, drivers of changes are to be identified by the company representatives, answering to the question "what is likely to have the greatest impact on our business tomorrow".

Drivers can be either very *generic / global* drivers, or *industry-specific*. They should preferably be *external* drivers, i.e. not controllable by industry players/stakeholders, but can included some *internal* drivers, as long as they are believed to be highly significant in how the future will develop, and hard to act upon.

Having identified the often numerous forces, these are categorized, analyzed and further described with precision. A set or combinations of key drivers are then classified with respect to the (envisioned) *degree of impact* of these drivers on the focus area and the *degree of uncertainty* of the outcome of these drivers of change. This being done, key drivers are identified as the ones with high impact and high uncertainty (upper right quadrant in figure 11). Keeping in mind that uncertainty and change form the core if scenario-planning, these "high-impact/high-uncertainty" drivers are regarded as the most important drivers to serve as basis for defining the scenarios that will represent structurally different but all plausible descriptions of the future.
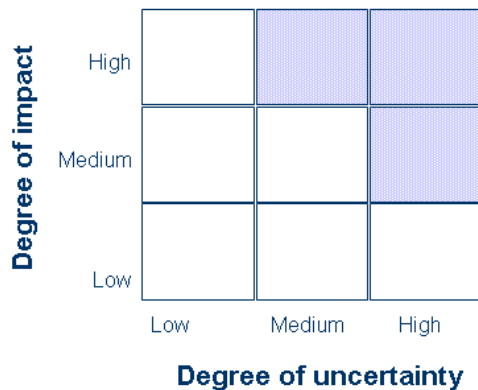

Figure 11: Impact / Uncertainty Matrix for classification of Drivers of Change

When working with scenarios, it is necessary to recognize that the *real* future will not be any of the scenarios, but rather contain elements of the scenarios. The objective of the scenarios is to pin point the corners of the plausible futures, the outer limits of what is possible.

Thus, while the elements characterized as key driving forces are the ones that will define the overall framework of the scenarios, some other drivers, less uncertain or with lower foreseen impact, should also be integrated in the building of the scenarios, as reference points, main signal posts, descriptive elements, or minor facts that give more consistence to the scenarios.
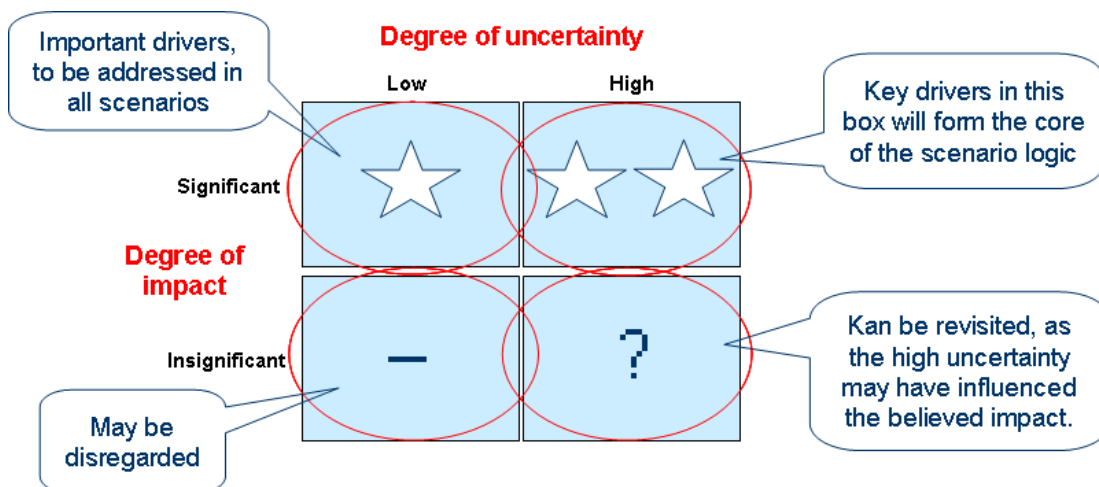

Figure 12: Analysis of Change Drivers according to their relevance for the future scenarios

Finally, in order to better understand and follow the developments of a driver and enhance the focus on the objectives of scenario planning, a monitoring system can be set up. By monitoring the driving forces, a company may identify emerging scenarios and establish an early warning system. It is important to adjust the monitoring techniques in accordance to the different characteristics of the key drivers. The information has to be analyzed in order to evaluate the impact, especially when monitoring qualitative key drivers. To make this manageable, the information gathering has to be filtered into both quantitative and qualitative variables. Still, attempting to quantify any qualitative elements is risky, as it may rely too much on subjectivity.

Another way to help monitoring key drivers is to establish a set of main categories of drivers and associated trends, and regularly update this database in order to make phase 2 (identification of drivers) more efficient.

4.2.4 Phase 3: Develop Scenario Logic and Scenarios

Having identified, analyzed and classified the drivers for change, the next step consists in **developing the scenario logic and the scenarios**.

The scenario logic is divided into two parts: one governing the consistency among all the drivers, and the other governing the two key drivers that define the framework for developing the scenarios.. According to the methodology, the scenario logic consists of a matrix with four distinct scenarios, which two axes are defined by the key drivers and their plausible evolution (see figure 14).

Other approaches may be applied (more inductive ones), but the logic is the same, meaning that all the identified drivers will define the **path of the scenarios** and represent elements that can transform the business environment a company is operating in.

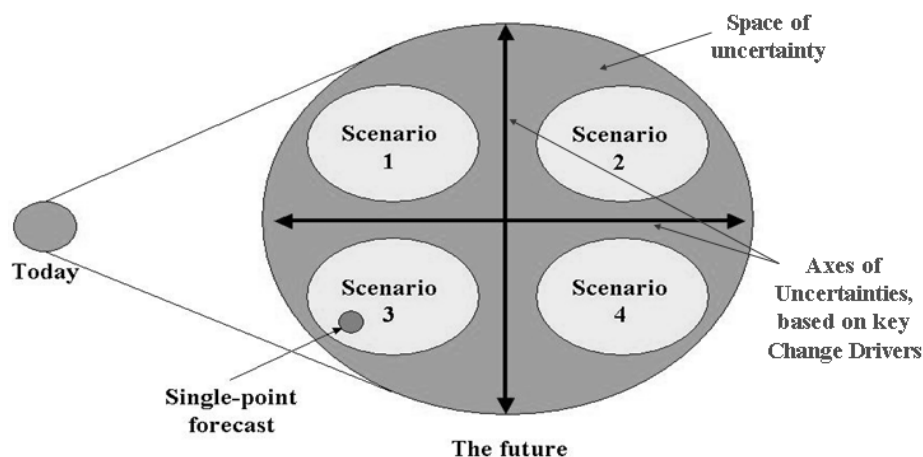The figure below illustrates the scenario logic.

Figure 13: Schematic representaiton of Future Scenarios

- In the "future" area, the grey area represents the scope of uncertainty.
- The four bobbles correspond to distinct plausible futures, each encompassing a set of drivers and associated uncertainties, and put together as one alternative future state of affairs.

- The axes are defined by the key driving forces, believed to be the two main dimensions that will have the greatest impact on the future and yet representing a high level of uncertainty.
- The little grey point represents a particular forecast, and shows that forecast can only be done independently of other forecasts, but hardly manageable as a group. This gives little possibility to study the interaction among the various forecasts, expect from statistical correlations, which is a highly quantitative approach, contrary to the scenario approach.

Once the scenario logic is established, the scenarios can be built more in detail. One of the most important objectives in a scenario process is to establish an enhanced level of insight and understanding of the future (foresight). Drawing a development path can help in establishing clarity in how the scenarios are foreseen. The diagram below is an example from the WWL scenario project (2000). It corresponds to a development path for one given scenario, and shows how main driving forces (in yellow) are foreseen to develop and which impact they are believed to have in the future.
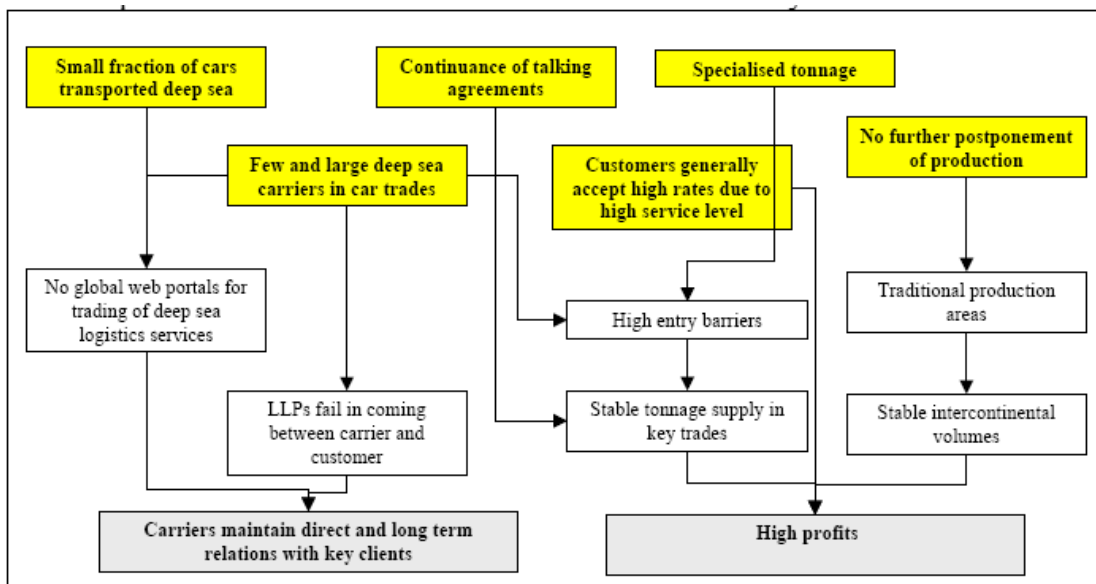

Figure 14: example of development path to describe a scenario (MARINTEK, 2000)

Developing the foundation for the scenarios is vital, but the creation of the scenarios determines the broader usefulness of a scenario process. Out-of-the-box thinking being the primary output of a scenario exercise, the way in which to present the scenarios must in fact trigger imagination. Visualization is important. A movie can be produced or a picture may be painted. News articles or interviews are also used to express the future vision of a scenario, and are a good way to present in a brief but very understandable manner the distinct scenarios. This is the technique mostly used by MARINTEK, supported by illustrative images.

Each **story-line** describes how the future scenario emerges in a cause-effect evolution from today's situation. The example below is from Statoil subsea operations, presenting four scenarios in their summary form, for which the two key drivers for future change were identified as the *type of organization to be governing global subs-sea activities*, and the *technology to be mostly used*.
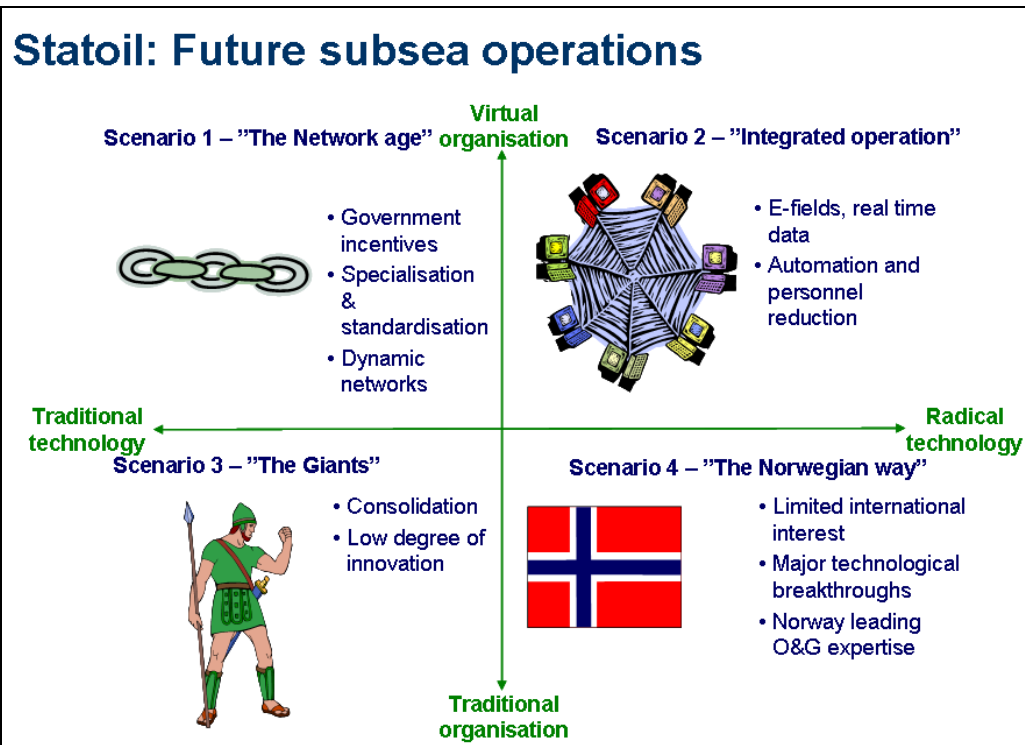
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Figure 15: Four scenarios for Statoil's future subsea operations (MARINTEK, 2003)

Another approach can be best case / worst case scenarios, if little resources and little time are available, at least to highlight the uncertainty of the main drivers and show two completely different plausible future outcomes.

4.2.5 Phase 4: Assess Scenarios

This phase looks at the implications of the scenarios for strategy-planning.

The assessment of the scenarios is when you "bring your foresight home", either **to test the existing strategies or to mobilize the resources for further action**, i.e. enhance the change readiness of the organization. Asking "what if" questions is essential to create open minds and to envisage implications if elements in future scenarios should come true. This prepares us for the threats and opportunities that may arise, and enhances the possibilities of first mover advantages as well as further business robustness.

Typical questions to be answered based on the foresight created through the scenario process are:

• What would be the threats and opportunities for our field/business if scenario A or B would happen?

• Which strategy and actions would/should we take, if scenario A or B would happen?

• What do we have to supervise in scenario A or B, meaning which sign posts can help us orientate our strategy?

From that perspective, scenarios provide a future context and test-ground for the design of strategies today. The framework established through the scenario process can help strategy development in two distinct ways:

1. For identifying *robust strategy* – Strategies that are flexible, open and viable in any of the scenarios.

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2. For identifying *focused strategy* – Strategies that are optimal in one specific scenario.

Finally, the strategies developed based on the scenarios are not purely static, and should not be the ultimate purpose of a scenario process. Once established, such strategies should be followed-up and updated overtime, based on updated mental-maps and new scenarios. Typical scenario-based strategy-planning can take place every year or second year, going back to phase 0 and redefining the project scope; or more importantly back to phase 1, and updating the industry understanding based on knew knowledge, recent trends, and on insight gained through the strategy planning process itself.

4.3 Scenario PROCESS

While chapter 4.2 explains a methodology for building scenarios, there exist multiple way of conducting such an exercise. In fact, this methodology could well be applied in a desk-study, by one isolated person or team. However, such a use of scenario-building would miss a great part of its added-value, which lies in the *process* rather than the outcome. Scenario-building offers a learning-process and opportunity for creative thinking which enriches strategies and strategists more than by just providing images of the future as new ground for action.

We believe that scenario thinking/development is about thinking outside the box, beyond traditional (mental) boundaries; "What you don't know about". To enable this, provocation and interactivity is essential, and a solid foundation must be created. Senior management "by in" is an absolute must in scenario-building processes aimed at companies. Similarly, participation of experts and highly engaged stakeholders is essential for scenario-building at industry or country level. An important aspect is to select the right people and mobilize them. A commitment to really contributing in creative exercises is crucial, and last but not least the deliverables must be of a trigging nature, so that the team engaged in the scenario exercise can assess the implication of the scenario (phase 4) in the most objective and constructive possible way.

When establishing a scenario project, some of the main "ingredients for success" are:

- **Right mix of people for ensuring relevant knowledge / information**.

  The quality of the scenarios depends on the quality of the input in form of knowledge, views, opinions, and information provided for identifying drivers and trends. The quality of such input is directly dependent on the participants in the process. Because ownership of outcome often define the quality of a work, it is important that the people involved shall be the direct beneficiaries of the scenario process: top and middle management, main decision-makers, experts, industrial actors and stakeholders, operational representative, etc.; this to ensure relevance of the scenario and to keep focusing on a common interest defined at the beginning of the project.

- **A supporting team for efficient brainstorming and creative thinking.**

  To support the main participants in the scenario-building process, a team of facilitators is necessary to guide the participants in the right direction. It is essential that a facilitator is neutral (with no self-interest in the scenario-process), a good listener who manages to structure the input received form all participants in a correct and unbiased way, capable of driving the discussion / brainstorming in an effective manner, and able to motivate the participants to think outside the box, yet in a realistic way. Finally, for ensuring quality

and usefulness of the scenario-process, it is important that the team has good knowledge and understanding of the topic on focus. This can be assured through the phase 1, when industry, market and trend analyses are conducted and information gathered.

- **Interactive workshops for creative discussion and good learning-process.**

As mentioned earlier, creative thinking and brainstorming form the basis for new ideas generation and are success factors for scenario-building. A scenario project is therefore mainly conducted via workshops. The way these workshops are conducted and discussion structured is essential for ensuring a useful input to scenarios. The main focus of workshops shall be on identifying, analyzing and classifying drivers, and building the scenarios' logic. Nevertheless, an initial workshop aimed at presenting the benefits and principles of scenario-building, and more importantly, for awaking creative minds and encourage participants to think about the future, uncertainties, and possibilities beyond the common truth, is essential for the success of the scenario project.

Again, ownership of outcome being decisive for the quality of the scenarios, workshops must be regular, not too sprayed in time, for keeping the motivation at a high level, and participants must contribute to all phases of the scenario-building process, meaning that they also must be authors of the story-lines that describe the scenarios. This can be done by the scenario facilitators-team preparing drafts of scenarios which participants can correct and fine-tune.

To conclude, for avoiding misuse of the scenario-building methodology (presented in chapter 4.2), the project must be carefully defined and prepared, and the process must be conducted in the most professional possible way. As people and discussions are central to the process of scenario-building, attention must be put on selecting the right people and engaging them in active dialogues.

5. Conclusion:

The present paper was aimed at introducing the field of foresight and future studies, of which scenario-building is viewed as the most powerful tool.

Work conducting at MARINTEK has been presented, followed by a review of the methodological approach used for scenario-building.

This paper serves both for providing insight on what scenarios are and why they are necessary, as well delivering a guideline for conducting a scenario-building process at company-level or more generally for an industry or a country.

It is acknowledged that there are distinct techniques for using and building scenarios, and the approach taken at MARINTEK is process-based, qualitative and intuitive. Rather than relying on forecasts and unnecessary or unrealistic quantitative measures of future development, attention is put on the creative-thinking generated through the process, and on ensuring consistency of the story-lines that form the scenarios. The value of scenario building lies even more in the learning process than in the outcome of that process.

Nevertheless, there are many other techniques and approached to scenarios. Given that practitioners often are more comfortable with data and reliable measures instead of stories, the presented methodology would benefit from an extension towards the inclusion of more complex models able to represent a scenario, reconciling qualitative and quantitative approaches.

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