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From Future Scenarios to Roadmapping:
A Practical Guide for Exploring Innovation and Strategy

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Purpose

This methodology brief describes a procedure where we combine scenarios that allow us to anticipate and prepare for multiple futures with the process of roadmapping serving as a systematic decision support tool. This specific foresight exercise, from scenarios to roadmapping, can be conducted as a one to two-day workshop with 20-30 lead engineers or managers to gather information in an organisation.

Visionary Approaches for Corporate Foresight

Managing technologies and strategic planning of business development goes hand in hand in today's knowledge economy. Business planning in the long run involves planning of emerging technologies as well as anticipating and preparing for disruptive change in economy and society. This involves tremendous uncertainties. Both scenarios and roadmapping are flexible tools fitted to deal with uncertainties. Scenario-making is one way of anticipating possible futures to make better decisions today. Yet, scenarios leave us with many plausible futures, thereby making it difficult to choose which path to follow as each scenario projects a storyline with emphasis on different drivers and ridden with uncertainties. Traditionally, scenarios have been developed to support the formulation of a vision and mission statement for the most desired path of development. However, scenarios have been criticised for being too distant to support strategy development. Roadmapping, on the other hand, is a very precise tool oriented towards decision-making in the present, but it may exclude important uncertainties as the focus is on one single future. The roadmap is a way to illustrate and communicate alignments of technology, product development and market requirements and the right timing guided by a common vision (Phaal et al., 2004 and 2009). Technology management literature defines it as visualising the strategy and showing the route from the current situation to the desired future (Goenaga and Phaal, 2009).

In general, roadmapping is described as a structural, yet flexible tool when navigating in a sea of uncertainties. However, we claim there is a weak point in roadmapping not dealt with in foresight or roadmapping literature, namely where the vision comes from. The reason could be that technology roadmapping so far has mostly been part of technology management where the vision is given. This may stand in opposition to strategic management where the vision is developed. For sure, a shared vision is a strong driver for any process. The vision may be developed by top management, but in organisations it is important to actually make it a shared vision leading to shared actions (eventually a driver for the mission statement).

While participatory scenario-making provides visions for multiple futures, a roadmap operates with one vision only. In this paper, we propose combining the flexibility of multiple visions of scenarios with action-oriented roadmapping.

Positioning of a Systematic Decision Support Tool

Only a few previous studies in foresight have dealt with the practical side of linking scenarios with roadmapping. Lizaso and Reger's article from 2004 provides a theoretical discussion of the value of linking roadmapping with scenarios for strategic technology planning. They describe a step-by-

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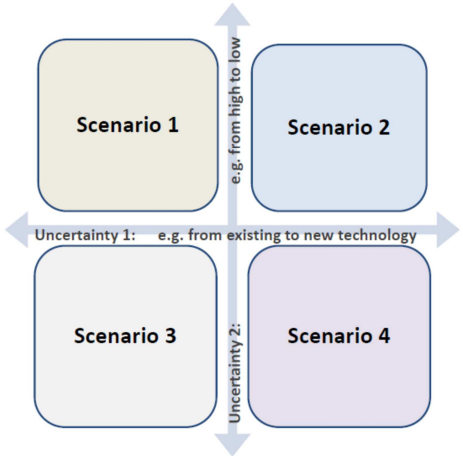
step process of creating scenarios to open up a variety of possible futures. However, they also perceive visions as desirable pictures of conceivable futures. Yet this is not necessarily so. In line with Saritas and Aylen's article from 2010 that roadmapping usually builds on one future and scenarios on multiple futures, we suggest that combining these methods will add value by exploring possible innovation paths and identifying knowledge gaps and critical decision-points at a given time, thus improving strategy-making. However, in contrast to Saritas and Aylen, who build one roadmap for each scenario, we use the scenarios to develop a common understanding, a common vision, which is a necessary requirement in a corporate setting.

This methodology therefore combines the four scenarios that allow us to anticipate and prepare for multiple futures based on a common vision, which serves as the driver for the roadmapping processes. Linking scenario-making to roadmapping involves moving from an exploratory study of possible futures towards a more goal-oriented strategic roadmap – meaning in *this case* that the scenario exercise is a playground for building visions.

From Four Visions to Consensus

Our point of departure is a group of lead engineers, technology managers or a division of a company – public or private – involved in exploring innovation and future developments (20-30 persons). The group has some insight in the present strategies of a company and the challenges it faces. The STEEPV acronym for the six themes of thinking about the future, social, technology, economics, ecology, politics and values, guides the search for future uncertainties (Loveridge, 2002; id. and Saritas, 2009). Examples are climate change, new technologies, political change and policy drivers, scarce resources (e.g. oil, gas and minerals), economic crisis, and social factors, such as demographic change, change in access to skilled staff, costumer needs etc. We use the STEEPV themes for trends and drivers up to 2025 to facilitate the construction of four future scenarios. The scenarios are constructed based on two identified uncertainties and a number of market drivers (Figure 1).

Figure 1. Four scenarios, two uncertainties

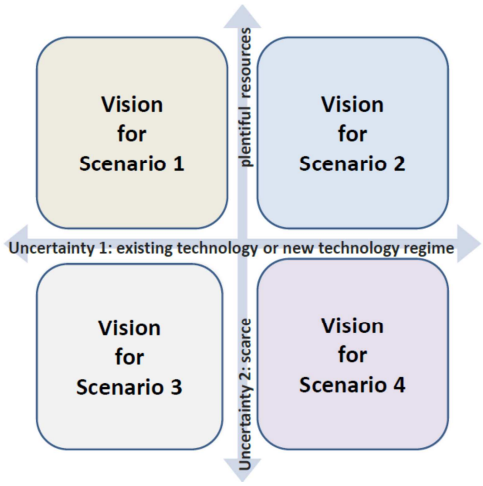


Managers justifiably involve experts in technology management to give technical and market advice, but often no one really exactly knows where technologies and markets are heading in the long run. This is where scenario thinking becomes important because it allows raising important questions:

Which set of multiple futures might be likely?
How can the company prepare for them?

The ***exercise*** divides the participants into four groups, a group for each scenario. The ***task*** is to give the scenario a name and formulate a short narrative formulated into a vision. A vision is explained as a desired picture of the company's position in each scenario given the uncertainties. Figure 2 illustrates the results.

Figure 2. Four scenarios, four visions



The next step is to synthesise the four visions into one common vision for the following participatory technology roadmapping exercise to build upon. Based on the four scenarios, the participants develop a common vision for the firm to meet the challenges envisaged up to 2025.

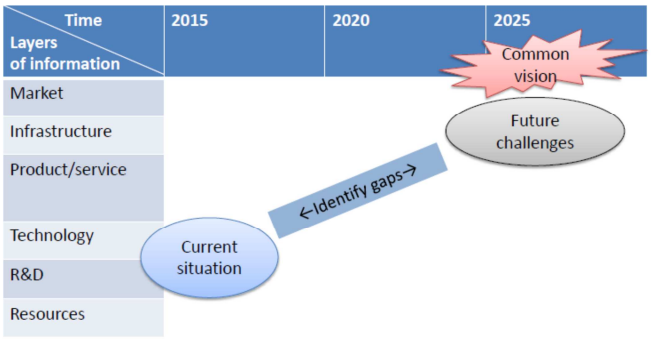
A Common Vision Is Developed in Plenum

The common vision exercise provides a bridge from the four scenarios to the explorative roadmapping process. It is based on a consensus process integrating the four visions from the scenarios into one shared vision. The common vision acts as the driver in the technology roadmapping process and provides guidance toward the desired future.

The group is then introduced to roadmapping, moving from an explorative strategic landscape towards a more goal-oriented technology roadmap. In plenum, the group is presented with a framework of the strategic landscape. The participants again apply the STEEPV themes, but this time they have a common vision and a timeline.

The common vision is placed in the framework to highlight the common direction. Post-its are placed along the timeline from the present up to 2025, aligning the layers as illustrated in Figure 3 and 4. Brief comments and discussion are welcomed as the post-its are placed along the layers.

Figure 3. Identifying innovation gaps



The outline in Figure 3 is adapted from (Phaal et al., 2009, Phaal and Muller, 2007 and 2009).

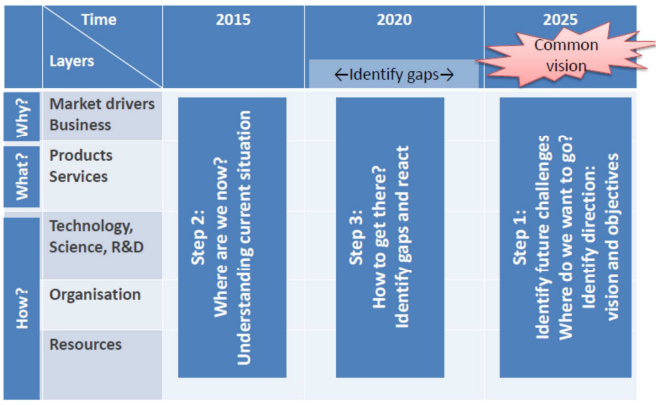
The information gathered using the post-its from the previous exercise is condensed into the plenum roadmap, and specific issues or new innovation ideas are placed, discussed and eventually ranked by each participant, placing a red dot on the most important ideas to be explored using the roadmap framework.

In our exercise, five technology roadmaps were developed, as there were five groups, providing five new ideas and five development paths for each idea or issue, which were in line with the common vision. The common vision should be seen as the key driver in the innovation process.

In general, the roadmap provides a visual representation of layers of information related to developments of technologies in the context explored.

The focus on condensing the complex information into one graphical framework is a key benefit of technology roadmaps, allowing to visualise market pull and technology push while checking for consistency in alignments of market and business drivers with product and services and R&D development to ensure the right timing for entering the market (Goenago-Larranaga and Phaal, 2010).

Figure 4. Design of the roadmap and structure



Manuel for a One-day Workshop: A Practical Guide to Our Methodology

First, we include a brief theoretical introduction to scenario thinking to create awareness among the participants for the social shaping of the future by showing the possibility of equally plausible alternative paths of development.

After the introduction follows a brainstorm session. First, each participant produces post-its for trends and drivers up to 2025 using the STEEPV themes as guidance. Thereafter, we conduct collective brainstorming in plenum where all post-its are placed on a large whiteboard. As facilitators, we cluster the post-its according to the STEEPV themes. The participants then vote on the most uncertain and most likely trends and drivers. The plenum consents on two drivers for constructing the scenarios. Using a simple matrix, the plenum constructs a framework for four scenarios up to 2025. Four groups work on constructing a scenario each based on one vision.

After the groups present each scenario and their vision, a consensus process in the plenum leads to formulating a consensual vision. The major value of this procedure is building cohesion around this common vision before introducing the roadmap framework.

The roadmapping exercise works with two types: strategic landscape and technology roadmapping. The common vision is the driver for the roadmaps since it guides the process towards achieving a desired future. The participants vote to determine the five topics they consider most import to be explored via roadmapping.

Five ***technology roadmaps*** – one on each topic – are developed in newly formed groups. The roadmaps support identifying current knowledge gaps if the desired future is to be reached. The framework allows the participants to recognise challenges and critical decision-points that one needs be aware of to respond in time to windows of opportunity.

The process ends by evaluating the exercises in plenum.

Meta-level Considerations

1. ***Learning from scenario-making***: We see scenarios as a creative way of inspiring innovation. The lesson to be learned from the scenarios is that the decisions made in the present are of strategic relevance to the future and thus actually part of shaping it since the long-term future is an open process. We therefore conclude that scenario thinking creates awareness of socially shaping the future by showing the possibility of equally plausible alternative paths of development in industry.

2. ***Learning point from the roadmap***: The point of the roadmap was to provide a strategic framework for aligning market trends and drivers with technology developments and setting priorities for R&D.

3. ***Combining scenario and roadmapping***: The value of combining scenario-building and roadmapping in this exercise is that scenarios allow us to anticipate and prepare for multiple futures while roadmapping enables identifying options for shaping a technology in more than one direction.

4. ***The strength of a common framework***: Our experience from using this guide testifies to the importance of familiarising the participants with the methodology as a flexible framework and exercise. All of the elements are key ingredients to bring together, for instance, lead engineers or stakeholders in an innovation system with the goal of developing a common vision, initiating innovation efforts, and aligning technology and innovation with trends and market drivers. This alignment supports decision-makers in being able to effectively respond to market changes and create the right timing for a new technology. Of course, neither roadmapping nor scenarios are silver bullets. Scholars such as Rob Phaal (Phaal et al., 2003) have argued that the true value of roadmapping lies in the ongoing process. We very much agree as roadmapping, albeit a strong tool for decision-making, has no miraculous future-telling powers. As practitioners of strategic projects know, uncertainties change and competing or promising technologies sometimes fail to reach market.

Creating the Future through Visioning and Roadmapping

Linking scenarios with technology roadmapping initiates an exploratory and creative phase aimed at identifying and understanding uncertainties. Scenario-building creates awareness for the possibility of more than one future, each of which is equally plausible. Roadmapping provides a framework for condensing all information into a single map and timeframe – revealing windows of opportunity and thus linking decision-making with alternative futures. The step from scenario-building to technology roadmapping requires creating a common understanding of challenges and establishing a common vision.

In exploring possible futures and visions, the participants are exposed to the basic assumption in foresight that the future in 20 years is open and it is possible to sense and seize opportunities and develop new technical and organisational skills or utilise existing ones.

An exercise of this kind can be conducted as a one-day workshop. However, we do recommend a two-day workshop since it leaves more time for group work and presentations. The role of the facilitator is of great significance; it is important to keep a positive attitude and perceive the workshop as an interactive learning process. Furthermore, the structured and systematic framework ensures a common context that makes facilitating the process easier. It may even provide a starting point for the participants to establish networks in the future based on this shared learning experience.

In conclusion, combining future scenarios and roadmapping can be useful in that the creativity provided by scenarios may help in making better decisions in developing the paths spelled out in the roadmap.

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