

# Strategic foresight for collaborative exploration of new business fields

TOBIAS HEGER<sup>i</sup>

*University of Potsdam, Chair for Innovation Management and Entrepreneurship*

*August-Bebel-Straße 89, 14482 Potsdam, Germany*

*tobias.heger@eict.de*

RENÉ ROHRBECK<sup>ii</sup>

*Department of Business Administration, Business and Social Sciences, Aarhus University*

*Fuglesangs Allé 4, 8210 Aarhus, Denmark*

*Email: rrohr@asb.dk*

*Abstract* – To ensure long-term competitiveness, companies need to develop the ability to explore, plan, and develop new business fields. A suitable approach faces multiple challenges because it needs to (1) integrate multiple perspectives, (2) ensure a high level of participation of the major stakeholders and decision-makers, (3) function despite a high level of uncertainty, and (4) take into account interdependencies between the influencing factors. In this paper, we present an integrated approach that combines multiple strategic-foresight methods in a synergetic way. It was applied in an inter-organizational business field exploration project in the telecommunications industry.

*Keywords:* strategic foresight, business field exploration, innovation management, open innovation

## 1 INTRODUCTION

In the past decades, much knowledge has been generated of how to conduct foresight activities. In the 1960s, scholars started to study national foresight programs. They aimed to identify future technologies that would generate the largest potential for economic welfare [1]. In a corporate context, foresight activities have been employed to make better long-term decisions [2, 3], support innovation activities [4] and strategic planning by identifying alternative trajectories [5] for emerging technology [6] trends and creating future scenarios [7]. As a result, we now have a rich body of knowledge of methods that can be used to address specific management challenges.

In our literature review, we argue that more knowledge is needed to successfully apply strategic-foresight techniques to complex planning tasks such as exploring new business fields [8-10]. From a company's perspective, new business fields are characterized by a multi-dimensional uncertainty [11] that results in typical planning questions such as: Is there an underserved demand? If yes, how much are customers willing to pay? How can the demand be satisfied? Should we address the market with a product, a service, or a hybrid product that combines both a physical product and a service? Which (emerging) technologies should be used to build the product and service? How will we produce? Is the business opportunity financially interesting?

This multi-dimensional uncertainty translates into the "chicken or egg" dilemma: if the firm does not know which technologies it should employ to build a certain product, it will not be able to define the properties of the final product. If the product properties are unknown, it cannot ask its potential customers how much they are willing to pay. If the willingness to pay is unknown, so is the business potential. This will make it impossible to take the required investment decisions. This dilemma results in a dual planning challenge: (a) dealing with uncertainty, and (b) dealing with the interdependencies between the multiple aspects of the new business fields.

Our point of departure is the expectation that strategic-foresight methods could help to reduce the uncertainty and that the challenge of interdependencies can be met by integrating multiple methods. More specifically, we expect that strategic foresight could help in (1) combining an external trend analysis with an internal analysis [12], (2) facilitating the strategy-formation process [13-15], (3) supporting strategic decision-making [16, 17], and (4) moderating innovation planning [4, 18].

Based on strategic-management frameworks and strategic-foresight methods, we have developed such an integrated methodology that is designed to support collaborative business field exploration. In this article, we report on the application of the methodology in a pilot project that aimed to explore the new market for intelligent and adaptive management of broadband networks. This is a potentially large market that enables the delivery of high-quality services over the Internet such as Internet Protocol-based Television (IPTV), multimedia services that build on high-quality video streaming, or broadband-intensive cloud-computing applications that require reliable connections. It is also a new business field in which multiple parties need to work together to jointly create a market and come up with solutions. In our case, a consortium of nine partners from academia and industry came together to conduct the project collaboratively.

## **2 LITERATURE REVIEW**

In the following literature review, we show why strategic planning of new business fields is particularly challenging and why we expect that those challenges can be met effectively with an integrated strategic-foresight methodology.

### *2.1 The challenge of exploring new business fields*

When Jeffrey Immelt says that ‘Constant reinventing is the central necessity at GE...We’re all just a step away from the commodity hell’, he emphasizes the need to continuously create new products and move into new business fields [19]. This has also been discussed in

strategic-management literature; it is concluded that companies need to master two roles: the first role is to improve processes and incrementally improve their current portfolio of products and services. The second role is to continuously explore new business fields [20]. Companies that are good at both roles are called ambidextrous organizations [21, 22].

Companies such as Nokia have shown how moving into new business fields can be done successfully. In its 150-year history, Nokia has changed from a pulp-and-paper company and from producing rubber boots and tires to becoming the world's leading manufacturer of mobile phones [23]. Nowadays, Nokia is at the brink of becoming a service company, which would be the third major transition and the third time that the company has moved into a totally new business field.

However, many companies continue to struggle to move into new business fields for multiple reasons:

- Information on *emerging business fields is not detected* by corporate sensors who are directed towards the current business [24], foresight could help by proactive scanning.
- Top management suffers from an overflow of information and *lacks the ability to access the economic potential* [25, 26], particularly if faced by multi-dimensional uncertainty. In this case, foresight could show the interdependency between the signals from different perspectives (competitive environment, emerging technologies, customer needs, etc.).
- Information on business potential is *filtered by a middle management* which fears that the new business may cannibalize current business [27, 28]. This means that foresight should ensure to reach or, even better, integrate top management in the exercise because participation is the best way to lay the basis for decision-making and taking action [8].
- Complexity of company structure that triggers *inertia* and prevents companies from

seizing business opportunities because they are too slow to react [29, 30]. This increases the need to reach top-level management with foresight results and include not only top management, but also other relevant internal stakeholders [31].

That means that in order to support business-field exploration with foresight activities, companies need to be able to *integrate multiple perspectives, integrate stakeholders throughout the process* of the foresight exercise, and ensure top-management visibility or, better, *top-management participation*.

## 2.2 Planning new business fields

Planning new business fields has many similarities with strategic planning, it

- concerns the *long term*, in which the investment is expected to pay off [32],
- aims to create a *synthesis* of what should be achieved and how the firm can achieve it [33, 34],
- involves *looking ahead* and, to a certain extent, forecasting and anticipating possible futures [12, 31],
- requires *integrating stakeholders* to tie planning to execution [33], and
- needs to *encourage* strategic thinking and *support* the strategy formation/new business-field exploration process [35].

We can therefore tap into the much larger pool of knowledge that has been created in the field of strategic management to define what should be done in a new business-field exploration project. In particular, we want to use three groups of frameworks as guides to the relevant questions and aspects in a new business-field exploration project:

- Porters 5 Forces help to grasp the *extent of competition* in a (new) market [36].
- Business-modelling frameworks direct the analysis towards the *major elements of a viable new business field* [37, 38].
- Business-planning frameworks ensure that all *important aspects of founding a*

*company* are taken into account [39].

For our new methodology for business-field exploration, the elements of all three frameworks were considered as potentially relevant aspects for our analysis. Table 1 shows how the elements of the three frameworks match with the elements of our analysis.

<i>Our foresight project</i>		<i>Elements of guiding frameworks</i>		
<i>Dimension of analysis (method)</i>	<i>Targeted elements</i>	<i>Porter's 5 Forces</i>	<i>Business modelling</i>	<i>Business planning</i>
Product properties (use-cases, target-costing pre-phase)	<ul style="list-style-type: none"> <li>• Value proposition</li> <li>• Relative product advantage</li> <li>• Product positioning</li> <li>• Targeted market segment</li> <li>• Strategic fit</li> <li>• Customer expectations</li> </ul>		<ul style="list-style-type: none"> <li>• Value proposition</li> <li>• Customer segments</li> <li>• Key activities</li> <li>• Key resources</li> </ul>	<ul style="list-style-type: none"> <li>• Technology plan</li> </ul>
Competitor analysis (Value Network and MACTOR*)	<ul style="list-style-type: none"> <li>• Up- and downstream partners</li> <li>• Industry growth and profitability</li> <li>• Competitors' strategies</li> <li>• Rivalry, competitiveness and new competitors</li> <li>• Power structures</li> <li>• Convergences and divergences of interests</li> </ul>	<ul style="list-style-type: none"> <li>• Rivalry among existing competitors</li> <li>• Bargaining power of buyers</li> <li>• Bargaining power of suppliers</li> <li>• Threat of new market entrants</li> </ul>	<ul style="list-style-type: none"> <li>• Key partners</li> </ul>	<ul style="list-style-type: none"> <li>• Competition</li> <li>• Strategic position</li> </ul>
Market analysis (scenario analysis)	<ul style="list-style-type: none"> <li>• Environmental conditions (political, regulatory, and sociological)</li> <li>• Market and technology trends and drivers</li> <li>• Future market configurations</li> </ul>	<ul style="list-style-type: none"> <li>• Threat of substitute products and services</li> </ul>		<ul style="list-style-type: none"> <li>• Industry analysis and trends</li> <li>• Target market</li> <li>• Risk assessment</li> </ul>
Financial analysis (target-costing)	<ul style="list-style-type: none"> <li>• Production costs</li> <li>• Customers' willingness to pay</li> <li>• Sales estimates</li> <li>• Revenue estimations</li> <li>• Market potential</li> </ul>		<ul style="list-style-type: none"> <li>• Revenue stream</li> <li>• Cost structure</li> </ul>	<ul style="list-style-type: none"> <li>• Financials</li> </ul>

*Elements that have not been adopted from the guiding frameworks:*  
*Business modelling*—customer relationships, channels  
*Business planning*—company description, marketing and sales plan, operations, management and organization, community involvement and social responsibility, development, milestones, and exit plan  
 \* MACTOR stands for Matrix of Alliances and Conflicts: Tactics, Objectives, and Recommendations [62].

**Table 1: Elements for new business-field exploration.**

In the first phase of the analysis, *product properties* are clarified. Particularly, we address the product's value proposition, its uniqueness or relative advantage over competing

offers, its positioning against competing offerings, and a clearly defined target-market segment and its match with corporate strategy. Additionally, a first evaluation of the customers' needs, wants, and expectations is conducted.

Concerning the *competitive environment*, it needs to be clarified how to deal with up- and downstream partners, i.e., in particular whether there may be shifts of power in the value chain and identification of potential new suppliers and buyers. Taken together, these aspects have also become known as the value network [40, 41]. In this network, it needs to be clarified whether there are potential alliances or latent conflicts that would favour or prevent a successful market entry.

The *market analysis* includes an analysis of the environmental conditions (political, regulatory, and sociological factors), identification of market and technology trends and drivers, and an analysis of the development of possible future market configurations. The latter serves as basis for strategy development later on in the process.

In the last dimension of our analysis—*the financial analysis*—, the insights from the first three areas are used. Complemented by an estimation of the customers' willingness to pay for the new product, it allows a first evaluation of the commercial attractiveness of the new business fields. A preliminary forecast of the market potential is often needed to convince decision-makers to support the decision to move into a new business field.

In the first two chapters of the literature review, we have seen why exploring and planning new business fields is particularly challenging. Overall, it can be said that there are two major challenges: (1) ex-ante uncertainty about a wide range of aspects of the business fields and resulting business model, and (2) interdependencies between the aspects that make cooperation between corporate departments and decision-makers necessary. In the next two chapters, we will discuss why a combination of strategic-foresight methods can be expected to help when facing these challenges.

### 2.3 *Strategic foresight to deal with uncertainty*

Strategic foresight in a corporate environment is concerned with reducing the domain of the unknown and helping to account for uncertainty in the decision-making process [10, 42]. In the French tradition, strategic foresight (prospective) is even seen as a learning process through which the future (in our case new business fields) is invented and created [42-44].

The most popular method of strategic foresight is scenario analysis. It has been shown to be able to create a structure that allows managers to take a higher number of arguments into account and grasp the systemic nature of the decision [45, 46]. At the same time, it can be used as a platform to ensure participation of relevant stakeholders and decision-makers [47] and can also have an impact on the perceived quality of the strategic decision-making [15].

In practice, it can be expected that methods have to be chosen [8, 48] and tailored to fit the task [12]. Strategic-foresight methods are expected to make a company aware of its environment [49, 50] and make strategic decisions more robust to future change by integrating wild cards (i.e., future events that are singular, sudden, surprising, and shattering) in the analysis [51].

We know that companies are increasingly using strategic-foresight methods [14, 52]. But it is also suggested that more research is needed on how strategic-foresight activities are embedded in decision-making processes and what value they generate for companies [53]. Some studies have identified potential value contributions [32]; other studies supply first evidence about the impact of strategic-foresight activities [54, 55]. In addition, studies have shown that some companies rely on complex strategic-foresight systems [56, 57] to increase their innovation capacity [4, 58, 59] and resilience against external (disruptive) change [25, 60, 61]. For example, some companies use the systems to assess the coherence between future trends and their strategy and product portfolio [62].



#### *2.4 Method integration for dealing with interdependencies*

The idea to combine foresight methods has a long history. In 1988, Flores and White proposed to structure literature on combined forecasting methodologies along two tracks: (1) “selection of the base forecasts” which determines which forecasts to include—qualitative, quantitative, or both—, and (2) the “selection of the method of combination” which is concerned with the approach to combine them, i.e., systematically, or in an intuitive way [63].

Armstrong [64] proposes to select methods based on their advantages and disadvantages, for example by combining quantitative and qualitative approaches. This view is shared by Dryampel and Filde. In their study, they give recommendations when to apply quantitative or qualitative methods [65, 66]. Instead of discussing quantitative and qualitative approaches, Ulrich argues that the focus should be on the difference between objectively existing aspects and interpretations and perspectives [67].

Prior to Clemen’s review of literature on combining methods [68], research on this topic centred on proving that combining methods does in fact increase accuracy. Metcalfe et al. [69, 70] propose to select methods solely based on multiple perspectives. They specifically argue that using different groups of stakeholders—thus leveraging their differing perspectives, opinions, and backgrounds—increases accuracy and the understanding of possible futures. Linstone [71] promotes a similar approach on a larger, national level. Based on empirical data, he shows the usefulness of considering technical, organizational, and personal perspectives.

Tseng, Cheng, and Peng [72] developed a model that combines a scenario analysis, the technological substitution model, and Delphi to provide market-penetration assessments. They argue that, in the end, the value of the common combination of a technological substitution model and a scenario analysis is often limited by a lack of available data on latest-generation technologies and quantifiable data. To overcome this problem, they integrate current opinions of seasoned experts to make a more holistic forecast. Their model generates market-share

predictions based on the scenario analysis and technological-substitution model, with both based on and supported by the results of expert estimations.

Kameoka, Yokoo, and Kuwahara review Delphi-Scenario Writing (DSW) [73]. In contrast to other combinations of Delphi and scenarios, DSW starts with Delphi and uses the scenarios to clarify the interrelationships between items that were identified during the Delphi forecast. Based on the results, adequate strategies can be developed.

Scholars have also reported on combinations of scenario analyses and roadmapping [74-77]. These combined methodologies usually start with an environmental analysis to identify key influencing factors and end with the development of differing scenarios that provide the basis for the interpretation and selection of the most favourable scenario for the company. During the development of a roadmap towards the favourable scenario, key events that need to take place to arrive at this scenario are identified and described. Finally, a tracking system can be set up to help to monitor the development towards the favourable scenario.

Petrick and Echols [78] introduced a heuristic method consisting of a combination of supply-chain management and technology roadmapping that heavily relies on IT (information technology) support. According to their argumentation, sustainable decisions in new-product development can only be made when the differing perspectives can be considered in an integrated way.

In conclusion, we have shown that combining foresight methods has been advised to (1) reduce deficiencies of the individual methods, (2) tailor the methodology to the task, and (3) integrate differing perspectives. Based on the first two chapters of our literature analysis, we like to add the objective to combine methods to (4) create a holistic view of a new business field that takes into account the interdependencies between the differing aspects of the analysis.

### 3 DESCRIPTION OF OUR CASE

#### 3.1 *The market of providing quality of experience*

Telecommunication network operators are confronted with an increasing need to reduce costs while increasing network capacity. New Internet services such as video streaming have led to a steep increase in network traffic. This results in the need to make network usage and management more adaptive and intelligent [79]. More specifically, the main trends that drive the need for better network management [80-84] are:

- Increase in *rich-media consumption*, particularly online videos. The increasing availability of IPTV offerings leads to additional network-traffic peaks, especially in the early evening hours.
- Increase in *personalization of online service*. This includes VoD (video-on-demand) services that replace linear television. On the network level, this implies a change from broadcasts with rather low network-capacity usage to unicasts which require separate connections for each user.
- *Media consumption independent of time, place, and device*. Future media offerings will allow watching any video content at any time on all devices. This implies that videos, for example, will be streamed increasingly through mobile networks with unicasts.
- Rise of *end-users' quality expectations*. The quality expectations rise after years of dominance of low-quality video content on the Web. The latter is of special importance for IPTV services since the minimum requirement for IPTV is a perceived quality level similar to that of conventional TV reception.
- Aim to *increase network efficiency*. At present, bandwidth assurances are given based on overprovisioning, i.e., greatly over-dimensioned networks have to ensure functionality, even in peak times. Network operators increasingly seek to increase

network efficiency to downscale overprovisioning and save costs.

The expansion of fibre networks—which will greatly increase network capacity—is currently underway, e.g., with FTTH (fibre-to-the-home) or FTTCab (fibre-to-the-cabinet) roll-outs [85]. However, fibre networks require massive investments in infrastructure and are expected to only postpone the impending problem of congestion [86]. Additionally, massive overprovisioning through fibre connections means that, most of the time, network load is nowhere near a network's full capacity [83, 87]. Thus, intelligent mechanisms to increase network efficiency remain of interest, even if the fibre network roll-out is complete.

Finally, advanced network mechanisms as analysed in RUBENS have the potential to open up new business fields for telecommunications operators who seek to regain their dominance in the ICT market by moving into the service market [88, 89].

### *3.2 Selection of the appropriate team*

When selecting an appropriate team for a strategic-foresight activity, multiple aspects are important. It has been suggested that an ideal foresighter has six characteristics: he is (1) curious and receptive, (2) open-minded and passionate, he has (3) broad knowledge, (4) deep knowledge, (5) a strong external network, and (6) a strong internal network [8]. In our project, most of the participants had a background in research and development as well as some experience in a business- or marketing-related position. In addition, it was important to find people who were intrinsically motivated to engage in a future-oriented project.

For a new business-field exploration project, it is also essential to involve people who can provide differing perspectives. In our case, that translated into the need to have participants with knowledge of the core network, access network, and end-user service domain. Inviting experts to specific workshops and interviews further strengthened the interdisciplinary character of the team. The external experts ensured that all relevant aspects were taken into account and that the perspective or lack of knowledge of individual team

members did not bias the results of the analysis.

It is also important to directly involve decision-makers to build trust in the results of the analysis [90] and middle managers to ensure their commitment to implementation and prevent organizational inertia [28, 91]. In our case, both groups were not only present at regular steering-board meetings, but also, and more importantly, actively participated in workshops, which created commitment.

### 3.3 Combining multiple foresight methods for new business-field exploration

Within the RUBENS project, the potential new business field was explored along four strata.

These were guided by four key questions:

- Q1: what are the key *product properties* (including the question whether services should be included and a hybrid product should be offered)?
- Q2: who are the relevant *actors in the value network*, what are their interests, and how will they behave in the new market?
- Q3: how will the *market* of the new business field evolve? What are the trends and the barriers?
- Q4: has the new business field the potential to become *financially viable*?

These questions were used to structure the project, define the project tasks, and coordinate the participating organizations.

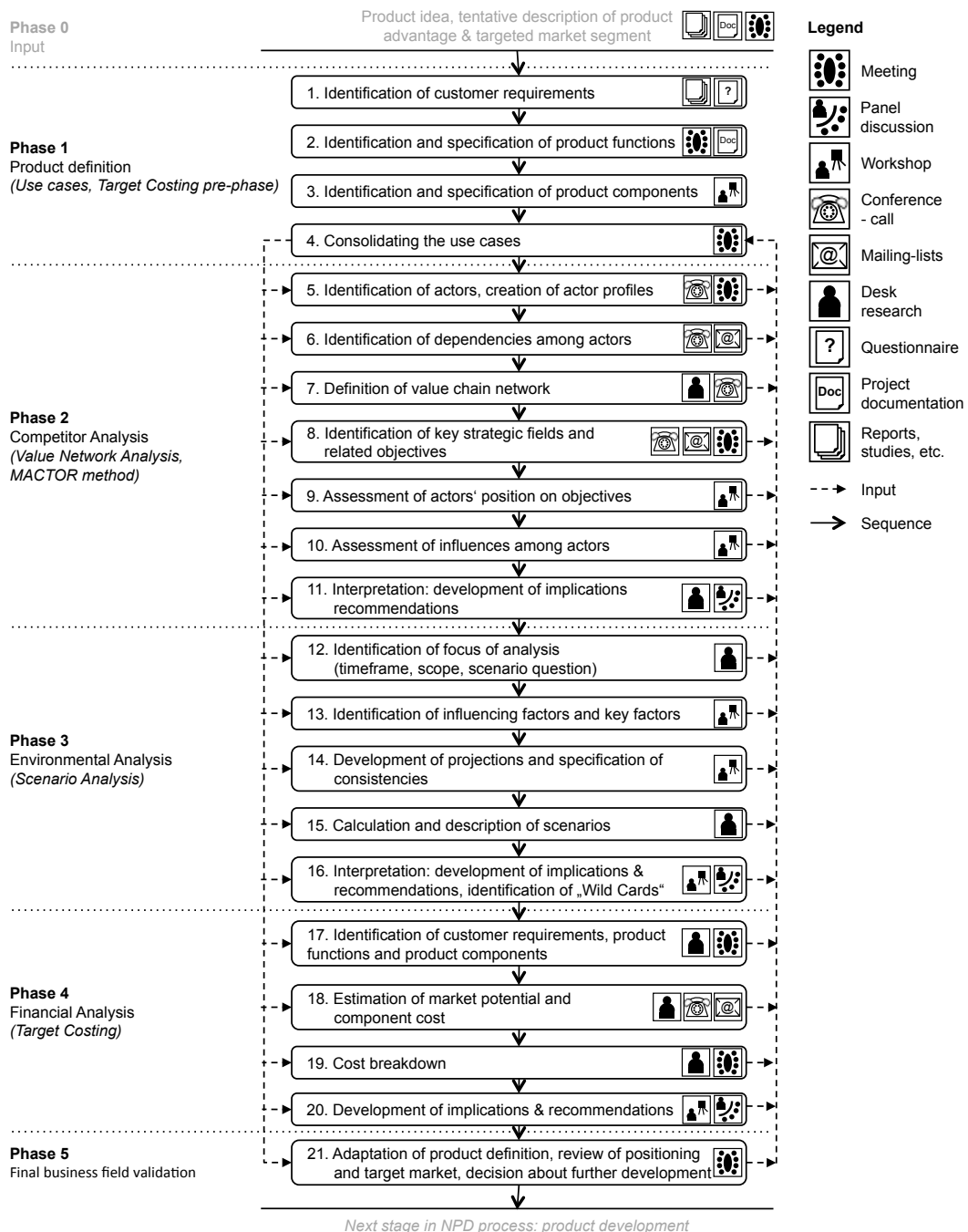
Throughout the process, various tools were used, for example workshops, reports, or our own desk research. Table 2 provides an overview of the main field of application of the various tools and a brief description why and how we used them.

<i>Main field of application</i>	<i>Tool</i>	<i>Description</i>
<i>Data collection (primary sources)</i>	Questionnaire	Survey to collect new and unique information that is not available in other sources
<i>Information gathering (secondary sources)</i>	Reports, studies, etc.	Gathering of scientific or other high quality information
	Project documentation	Gathering of information available in other work-packages of the project

	Desk research	Gathering of universally valid information and public information
<i>Generation and discussion of results</i>	Workshops	Moderated and interactive face-to-face meetings to generate input from and results by the project team
	Panel discussion	Moderated face-to-face meetings to present and discuss controversial (intermediate) results: one presenter, multiple discussion partners in the panel, and the tool of choice to integrate external experts
<i>Information presentation</i>	Meetings	Face-to-face meetings without moderator where either information from the team members is gathered or results are presented
	Mailing lists	Send-out of project documentation for validation
	Conference calls	Clarification of project progress, discussion about minor issues or intermediate results

**Table 2: Fields of application and description of the tools used.**

The project was divided into five phases. Before the first phase, an initial collection of input laid the basis for the following analysis (phase 0). Phases one to four addressed the four guiding questions mentioned above and phase five prepared the conclusions and developed recommendations for decision-making. An overview of the project execution is shown in Figure 1.



**Figure 1: Project structure to explore a new business field.**

### 3.3.1 Phase 0: input collection

At the start of the project, input for the analysis of the new business field was collected from several sources:

1. The documentation of base technologies
2. Publications in scientific journals

3. Reports and studies published by research institutes and public institutes
4. Internal studies that were conducted by the project partners
5. Articles in non-scientific journals and newspapers

### *3.3.2 Phase 1: product definition (use-cases)*

To operationalize product properties without predefining how the product should be built or which technologies should be used, the product was defined through use-cases. A use-case is an iterative process in which experts with a technological perspective (including technology foresighters who supplied future-oriented information) gave recommendations on the long-term perspective and experts with a market perspective were consulted on current and emerging customer expectations. From a customer's perspective, these use-cases describe how the product is used, what benefit is generated, and how it interacts with the telecommunication network. These use-cases were developed by (1) defining the customer requirements, (2) defining the specific product functions, (3) clustering the functions into product components, and (4) the consolidation of the first three steps into use-case descriptions.

### *3.3.3 Phase 2: competitor analysis (value-network analysis, MACTOR method)*

The second phase started with the creation of a generic value network consisting of relevant roles and interfaces. These were developed on the basis of expert input and existing models (step 5). The value-network perspective becomes pertinent due to the increasing complexity of products and services [82, 83]. This was followed by the identification of actors that were relevant in the targeted market segment (step 6). Basic information about each actor was collected in "actor profiles", one-page summaries of basic information and relevant activities (step 7). To fill the profiles, they were distributed among the team members to search for relevant information in a two-week period. In order to ensure relevance and similarity of results in this research activity, a template was created and distributed to all team members.



The actor profiles contained information about:

- the organization's *roles* in the value network,
- its main *objectives* in regard to quality of experience,
- basic *company data* to indicate the size of the organization (revenue, number of employees),
- trends and disruptive technologies that posed substantial *threats* to the organization,
- own *influencing power* over other actors, and
- *exposure to influencing power* from other actors.

The actor profiles helped to consolidate data on the various actors and provided a structured way to gather preliminary input data for the MACTOR method (Matrix of Alliances and Conflicts: Tactics, Objectives and Recommendations). The MACTOR method is one of the few multi-actor issue analyses [84]. These analyses are applicable in situations that are difficult to foresee, in which multiple actors are involved and varying interests, perspectives, and options collide. We specifically chose MACTOR because it also recognizes differences in the power distribution in the value chain [92].

In step 8, key strategic fields—such as content, services, and devices—were identified and concrete objectives were derived that could be assigned to individual actors. Consistent with Godet's original approach [92], the strategic position of each actor on these objectives (their opinion of the objectives) was rated on a scale from -4 to +4, where -4 indicates total opposition to the objective and +4 indicates a complete match between the objective and the corporate strategy (step 9). In the next step, the data on the influence between actors was used to calculate the relative influences between the actors in the value network. The influences were weighted on a rating scale as well. The lowest value, indicating total independence was 0, whereas the highest value, 3, indicated a very high degree of dependence (step 10). Based on both the data from the opinions of the actors and their relative influences on each other, it is possible to map actors in a convergence and divergence diagram. Here, harmony and

hostility between actors are identified. This is the basis for identifying strategic fields where alliances and collaborations may be possible and where conflicts have to be expected. This allowed us to give recommendations on cooperation: with whom to collaborate, in which relationship conflicts have to be expected, and, based on the objectives, how to mitigate the conflicts by giving in to certain objectives of an adversary (step 11).

#### *3.3.4 Phase 3: market analysis (scenario analysis)*

The goal of phase three is to consolidate all relevant perspectives and answer the question how the new business field may develop in the future. The central method is scenario analysis; its particular strength is the ability to integrate a high number of influencing factors [93].

Before starting the scenario analysis, a further specification was made concerning time horizon, scope, and actor perspective, i.e., the role for which we want to generate insights and recommendations. The latter was a particularly tricky part because the new business field implied that the network operator might be well advised to extend his role portfolio in the value network (step 12).

In a one-day expert workshop, the most important political, sociological, economic, and technological influencing factors were collected and consolidated into 12 key factors (step 13). For each key factor, future projections were defined, i.e., the state of an influencing factor in the future. For each projection, the working group estimated its likelihood (step 14). Following this initial workshop, the consistency among all projections was assessed. That meant answering the question whether future state A of influencing factor 1 can occur with future state A of influencing factor 2 (step 15). With the help of scenario software, all possible scenarios and their inherent consistency were calculated. For five consistent yet very different scenarios, a detailed analysis and thorough description was created (step 16). To illustrate the meaning of each scenario, supporting images were added to the description.

In a second expert workshop, the resulting scenario descriptions were presented. After all participants had had sufficient time to familiarize themselves with the scenarios, implications and resulting recommendations were developed (step 17). In addition, so-called wild cards were identified. Wild cards represent events that have a major impact on the object of analysis, but occur suddenly and unforeseeably. For that reason, wild cards are not modelled into scenario analyses as influencing factors, but are taken into account after the scenarios have been generated. After identifying them, their importance and impact on the QoE (quality of experience) market and likelihood were rated.

### *3.3.5 Phase 4: financial analysis (target-costing)*

From the preceding stages, a deep understanding of the competitors in the potential market for QoE was achieved. In the financial analysis, the aim is to quantify the market potential and generate first estimations on cost, revenue, and profit. It was decided to use a target-costing approach. Here, inverse accounting is leveraged instead of traditional cost-plus methods. The price that the customers are willing to pay is taken as upper limit for the retail price and all steps of value creation are optimized to achieve the allowable retail price [85]. Business-field exploration activities are the beginning of a new product or service, thus the possibilities to significantly engineer value-creation activities are given; target costing can be applied optimally.

From phase 1, a first product definition already existed. For target-costing, it is required to particularly detail customer requirements and product functions and components. Product functions are descriptions of functionality that a product will deliver, e.g., video and audio quality, video-on-demand functions, or simultaneous multi-TV access. Product components, on the other hand, are the physical components that are necessary to realize the before-mentioned functionality, e.g., CPE (customer premises equipment) or CAS (control and application servers). The set of customer requirements and product functions and components

was identified by desk research and validated and extended with a questionnaire that was developed and distributed to a panel of 19 industry experts (step 17).

With the succeeding step 18, two things were done: an estimation of the market potential followed by an estimation of the expected component cost. For the market estimation, the project focused on six countries (Belgium, France, Germany, the Netherlands, Spain, and the United Kingdom). As is often the case when assessing new markets, there was no data available that directly addressed the customers' willingness to pay, in this case for IPTV quality enhancements. Therefore, the strategy for estimating the market potential was to work through analogies with available market data—here: online video services, conventional TV, and IPTV—and derive a reasonable willingness to pay from these. To estimate the number of potential customers, data on population, number of households, age distribution, broadband-access penetration, and weekly TV and Internet consumption was leveraged. On the cost side, the input data came from aggregated real-cost data from the participating equipment manufacturers and network operators.

Within the target-costing phase, we had two goals: first, to check if the market for the one product in question could be profitable overall and second, to identify components for which the costs have to be reduced to ensure product profitability. The latter was done by comparing the willingness to pay and the cost for a certain component (step 19). This allowed us to identify components that were in need of cost optimization, in our case the DSLAM (digital subscriber line-access multiplexer) and those that required additional investments for improvements, in our case the service platform. Overall, the financial analysis confirmed that the product had the potential to become profitable (step 20).

### *3.3.6 Phase 5: final business-field validation*

Overall, the project resulted in a positive assessment of the new business field, insights on drivers, barriers, showstoppers, and recommendations on how to enter the new market:

- The *use-cases* provided a firm ground to build a portfolio of products within the new market. This was the answer to question 1 mentioned above.
- The *competitor analysis* showed the need for alliances to successfully create and exploit the new market. This was the answer to question 2.
- The scenario analysis allowed us to *identify the antecedents* for the market creation such as network congestion. For example, it was revealed that the new market will only emerge if overprovisioning is declining, either because of a reluctance of network operators to invest in the extension of network capacity or an increase in data traffic through increasing demand for personalized high-quality video services or cloud-computing applications. This was the answer to question 3.
- For one product, the financial viability was demonstrated through *financial analysis*. This was the answer to question 4.

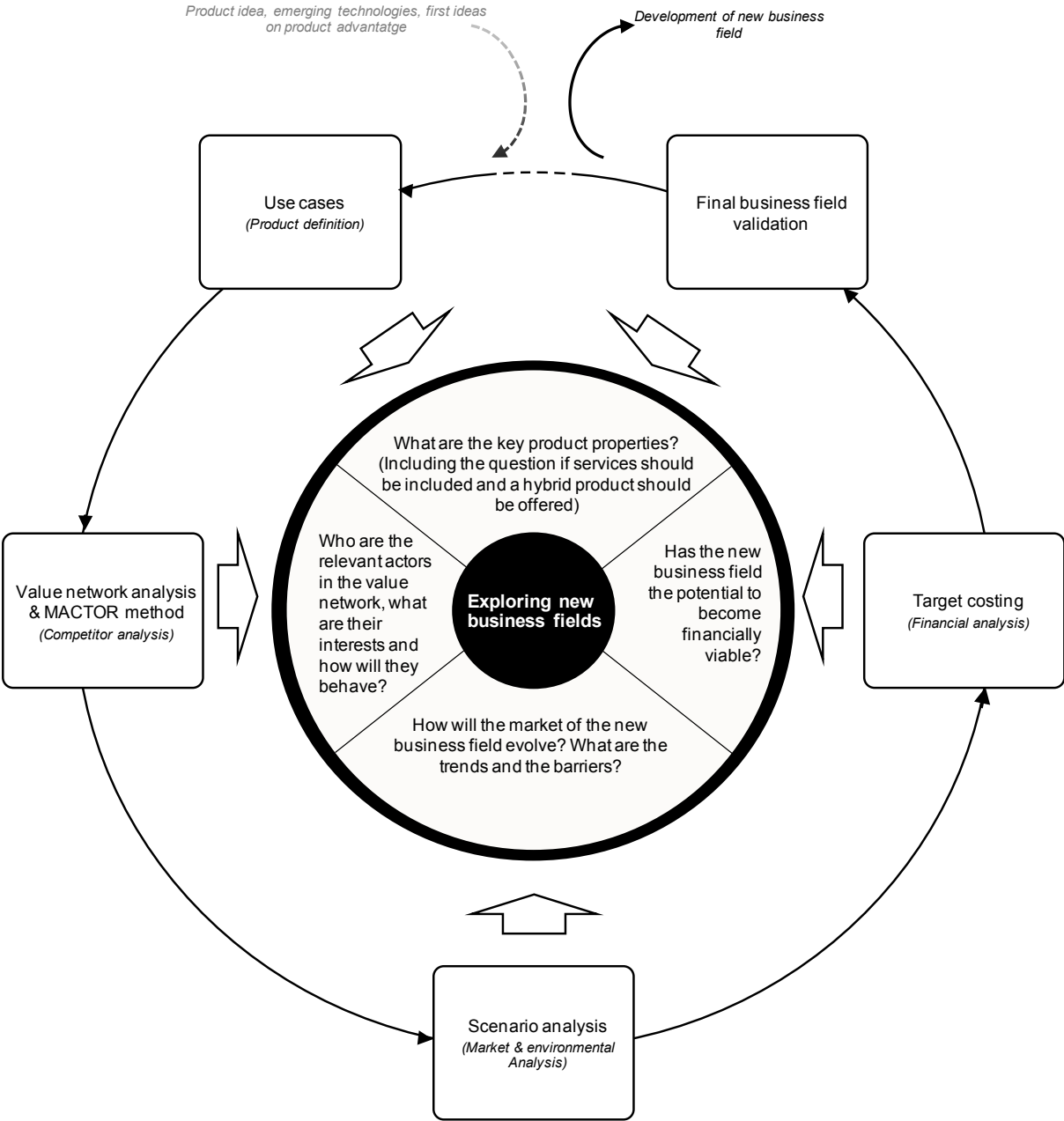
Collaborative market exploration was also the basis for further investigation within the participating organizations. Having participated in the collaborative effort allowed them to add to their own view the perspectives from other companies that play different roles in the value network. Thus, the reliability of the results was increased. In addition, they explained that the personal interaction in the workshops and team and steering-board meetings increased their confidence that results and recommendations could be trusted.

### 3.4 Process overview

In this case study, the aim was to use and combine foresight methods to explore a new business field. Figure 2 summarizes the approach. In our pilot case, the project was started to evaluate whether newly developed technologies could provide a basis for a new market. In other cases, the starting point may also be a product idea or the initial idea of an important product advantage.

After the initiation of the new business-field exploration project, four major phases were

identified. These phases followed the four guiding questions that are shown in the centre of Figure 2.



**Figure 2: Key questions and methods for exploring a new business field.**

To answer the questions, four methods were used:

- *Use-cases* were used to define the *product properties* without having to imply a certain technical solution. They define the product only through a description of how the customer will interact with the product.

- A *value network* was modelled and the *MACTOR* analysis was applied to model the interests of the *relevant actors* in the value network. This allowed us to identify potential conflicts of interest with other actors, predict the level of rivalry in the market, and identify potential alliances.
- A *scenario analysis* was used as the primary integrating method that allowed us to integrate observed trends from the technology, competitor, customer, and political environment. The result was a good understanding of the barriers to successful business-field development.
- Through a *target-costing* analysis, the qualitative insights of the previous phases were quantified and the overall *financial viability* was checked.

On the basis of this analysis, the consortium of organizations concluded that it was worth it to further pursue the QoE business field. The company that was the primary objective of our analysis held a top-management workshop that used the project output to define a roadmap for the development of the new business field.

### 3.5 Methodological synergies

As shown in Table 3, the integration of methods exploited synergies in the data collection and evaluation.

<i>Information</i>	<i>Processed by method</i>										<i>To develop</i>
	<i>Originally collected for</i>					<i>Re-used for</i>					
	<i>UC</i>	<i>VN</i>	<i>M</i>	<i>SA</i>	<i>TC</i>	<i>UC</i>	<i>VN</i>	<i>M</i>	<i>SA</i>	<i>TC</i>	
• Value proposition	X					X			X	X	Product properties
• Relative product advantage	X										
• Product functions	X						X			X	
• Target market segments	X								X		
• Customer expectations	X								X	X	
• Market potential	X									X	
• Product positioning	X								X		
• Strategic fit	X										
• Up- and downstream partners		X						X	X	X	Competitor analysis
• Interdependence among actors		X						X	X		
• Industry growth and profitability			X								
• Competitor strategies				X					X		

<i>Information</i>	<i>Processed by method</i>										<i>To develop</i>
	<i>Originally collected for</i>					<i>Re-used for</i>					
	<i>UC</i>	<i>VN</i>	<i>M</i>	<i>SA</i>	<i>TC</i>	<i>UC</i>	<i>VN</i>	<i>M</i>	<i>SA</i>	<i>TC</i>	
• Rivalry, potential market entrants, and competitiveness			X						X	X	
• Power structures				X					X	X	
• Convergence and divergence of interests			X						X		
• Environmental conditions				X							
• Market and technological drivers				X							
• Future market configurations				X							Market analysis
• Strategies to meet future market configurations				X							
• Production costs					X						
• Allowable retail price					X						Financial analysis
• Sales and revenue estimates					X						

UC: use-case method, VN: value-network analysis, M: MACTOR, SA: scenario analysis, TC: target costing.  
Note: The crosses in the “re-used for” column show the synergy effect of the method integration.

**Table 3: Synergies created by the method integration.**

In the first step, the definition of use-cases—the identification of customer expectations and product functions—creates a sound basis for the following steps of the methodology. The successive value-network analysis provides the foundation for the analysis of power structures, potential alliances, and conflicts that result in the development of strategic options in the competitive environment within the new market. The scenario analysis benefits strongly from the high degree of market knowledge that is established in the preceding steps. Finally, the target-costing analysis uses the insights from the product definition, customer needs, and market conditions as well as the knowledge of the power balance in the value network.

### 3.6 Strategies to facilitate collaboration

When exploring new business fields, we are dealing with an analytical problem that is characterized by a high level of *uncertainty* and *interdependency* between the sub-issues (i.e., what product features should be offered, what technologies should be used, what technologies are affordable given a certain set of features, etc.).

To ensure that we kept everyone informed about overall progress, to which extent uncertainty had been reduced, and aware of interdependencies, we



- provided enough *time to brief and re-brief participants* on what had been achieved in the past and what was expected as a result from the task at hand,
- held regular *face-to-face meetings* and at least bi-weekly *conference calls*,
- had two major *team-building events*, one at the start and one halfway through the 12-month project duration, and
- *visualized the project progress*, including the status of individual contributions (this also helped to put pressure on team members to deliver quality on-time).

Concerning the challenge of a high number of participants in project meetings, we

- distributed *preparatory homework* one week prior to the meetings,
- used *pre-structured questionnaires* to effectively collect data,
- supported discussions in the workshop with *templates* that had to be filled out collaboratively, and
- held *panel discussions* to reduce the number of participants discussing simultaneously.

In addition, collaboration beyond meetings needed to be organized in a way that allowed team members to build on each other's results while providing progress transparency. For that purpose, various IT-based tools were employed:

- *Wikis* (websites that can be changed in real time by all project participants) to document project results
- *Forums* to discuss the different sub-issues
- Online *mind-mapping* tools to collaboratively structure new topics during telephone conferences
- *Instant messaging* to facilitate direct interaction

Foresight projects in particular also rely on the knowledge, experience, and openness of its participants. An interdisciplinary team is also recommended to ensure that trends are sufficiently challenged and conclusions are validated from various perspectives. In our

project, this was achieved by inviting academic researchers, industry engineers, and business analysts to join the team. With respect to industry participants, it is advisable to cover all relevant actors in the value network, but this is often difficult to achieve. In our case, project partners included network-equipment manufacturers and network operators. Insights from the perspective of media companies or end-user device manufactures had to be brought into the project by interviewing external experts and other sources.

#### 4 CONCLUSION

In our literature review, we have argued that more research is needed to understand how foresight activities can be successfully applied in a corporate context. When companies wish to explore and develop new business fields, they are faced with a particularly challenging task that is characterized by (1) the need to integrate *multiple perspectives*, (2) a *high level of uncertainty*, (3) *interdependencies* between customer needs, technological capabilities, competitor behaviour, legislative contingencies, production cost, etc., and (4) the need to *involve a high number* of external experts and internal *stakeholders*.

We have discussed that it might have a merit to combine multiple foresight methods and shown that there are documented approaches that aim to combine foresight methods to (1) make them more reliable, (2) integrate qualitative and quantitative data, and (3) integrate different perspectives. In this paper we have described the application of an integrated methodology to explore a potential future market in the telecommunications industry. Therein we attempted to answer the following four guiding questions:

- What should the key product properties be?
- Who are the relevant actors, what are their interests, and how is power distributed among them?
- What are the barriers and drivers for the business field?
- Has the new business field the potential to become financially viable?

The sequence of the complementary methods exploits methodological synergies. Results and data that are only intermediate results from analyses used early on in the methodology are often re-used in later stages. Additionally, the methodology is highly interactive and fosters integration of cross-functional team members and calls for the involvement of external experts. Achieving optimal results with the proposed integrated methodology requires an iterative process. This, however, is difficult to realize due to time pressure and resource limitations in the exploration phase of new business fields.

It should be noted that not all new business fields can be explored with foresight and planned ex ante. In the absence of planability, companies have to rely on serendipity, i.e., start multiple business-field development initiatives and wait and see which will produce promising results. Therefore, companies will need to rely on corporate venturing schemes to move into new business fields through an entrepreneurial push [94] in addition to foresight activities.

## 5 ACKNOWLEDGEMENTS

This study was partially conducted as part of the RUBENS project of EUREKA CELTIC. The authors would like to thank all RUBENS partners for their valuable contributions, cooperation, openness, and feedback. Special thanks go to the Deutsche Telekom AG.

## 6 REFERENCES

- [1] K. Cuhls, A. Beyer-Kutzner, W. Ganz, and P. Warnke, "The methodology combination of a national foresight process in Germany," *Technological Forecasting and Social Change*, vol. 76, pp. 1187-1197, 2009.
- [2] V. A. W. J. Marchau, W. E. Walker, and G. P. van Wee, "Dynamic adaptive transport policies for handling deep uncertainty," *Technological Forecasting and Social Change*, vol. 77, pp. 940-950, 2010.
- [3] H. Eto, "The suitability of technology forecasting/foresight methods for decision systems and strategy - A Japanese view," *Technological Forecasting and Social Change*, vol. 70, pp. 231-249, Mar 2003.
- [4] R. Rohrbeck and H. G. Gemünden, "Corporate Foresight: Its Three Roles in Enhancing the Innovation Capacity of a Firm," *Technological Forecasting and Social Change*, vol. 78, pp. 231-243, 2011.
- [5] B. van Bree, G. P. J. Verbong, and G. J. Kramer, "A multi-level perspective on the introduction of hydrogen and battery-electric vehicles," *Technological Forecasting and Social Change*, vol. 77, pp. 529-540, 2010.
- [6] M. Coccia, "Technometrics: Origins, historical evolution and new directions," *Technological Forecasting and Social Change*, vol. 72, pp. 944-979, 2005.
- [7] P. D. Aligica, "Scenarios and the growth of knowledge: Notes on the epistemic element in scenario building," *Technological Forecasting and Social Change*, vol. 72, pp. 815-824, 2005.

- [8] R. Rohrbeck, *Corporate Foresight: Towards a Maturity Model for the Future Orientation of a Firm*. Heidelberg: Physica-Verlag, Springer, 2010.
- [9] J. Voros, "Integral Futures: An approach to futures inquiry," *Futures*, vol. 40, pp. 190-201, 2008.
- [10] T. J. Gordon, J. C. Glenn, and A. Jakil, "Frontiers of futures research: What's next?," *Technological Forecasting and Social Change*, vol. 72, pp. 1064-1069, 2005.
- [11] S. Makridakis and N. Taleb, "Decision making and planning under low levels of predictability," *International Journal of Forecasting*, vol. 25, pp. 716-733, 2009.
- [12] R. Vecchiato and C. Roveda, "Strategic foresight in corporate organizations: Handling the effect and response uncertainty of technology and social drivers of change," *Technological Forecasting and Social Change*, vol. 77, pp. 1527-1539, 2010.
- [13] T. U. Daim, G. Rueda, H. Martin, and P. Gerdtsri, "Forecasting emerging technologies: Use of bibliometrics and patent analysis," *Technological Forecasting and Social Change*, vol. 73, pp. 981-1012, 2006.
- [14] C. Daheim and G. Uerz, "Corporate foresight in Europe: from trend based logics to open foresight," *Technology Analysis & Strategic Management*, vol. 20, pp. 321-336, 2008.
- [15] T. J. Chermack, L. van der Merwe, and S. A. Lynham, "Exploring the relationship between scenario planning and perceptions of strategic conversation quality," *Technological Forecasting and Social Change*, vol. 74, pp. 379-390, 2007.
- [16] K. M. Eisenhardt and J. A. Martin, "Dynamic capabilities: What are they?," *Strategic Management Journal*, vol. 21, pp. 1105-1121, 2000.
- [17] F. Ruff, "Corporate foresight: integrating the future business environment into innovation and strategy," *International Journal of Technology Management*, vol. 34, pp. 278-295, 2006.
- [18] R. Phaal, C. J. P. Farrukh, and D. R. Probert, "Technology roadmapping - A planning framework for evolution and revolution," *Technological Forecasting and Social Change*, vol. 71, pp. 5-26, Jan-Feb 2004.
- [19] IBM Global Business Services, "Expanding the Innovation Horizon - The Global CEO Study 2006," 2006.
- [20] D. Levinthal, "Surviving Schumpeterian Environments: An Evolutionary Perspective," *Industrial and Corporate Change*, vol. 1, pp. 427-443, January 1, 1992 1992.
- [21] C. Andriopoulos and M. W. Lewis, "Exploitation-Exploration Tensions and Organizational Ambidexterity: Managing Paradoxes of Innovation," *Organization Science*, vol. 20, pp. 696-717, 2009.
- [22] M. L. Tushman and C. A. O'Reilly, "Ambidextrous organizations: Managing evolutionary and revolutionary change," *California Management Review*, vol. 38, pp. 8-30, Sum 1996.
- [23] C. Stadler, *Enduring Success: What We can Learn from Outstanding Corporations*. Stanford: Stanford University Press, 2011.
- [24] G. S. Day and P. Schoemaker, "Peripheral Vision: Sensing and Acting on Weak Signals," *Long Range Planning*, vol. 37, pp. 117-121, 2004.
- [25] H. Lesca and M.-L. Caron, "Veille stratégique : créer une intelligence collective au sein de l'entreprise," *Revue française de Gestion*, vol. 105, pp. 58-68, 1995.
- [26] J. H. Burgers, F. A. J. Van Den Bosch, and H. W. Volberda, "Why new business development projects fail: Coping with the differences of technological versus market knowledge," *Long Range Planning*, vol. 41, pp. 55-73, Feb 2008.
- [27] R. K. Chandy and G. J. Tellis, "Organizing for Radical Product Innovation: The Overlooked Role of Willingness to Cannibalize," *Journal of Marketing Research*, vol. 35, pp. 474-487, 1998.
- [28] Q. N. Huy, "Emotional balancing of organizational continuity and radical change: The contribution of middle managers," *Administrative Science Quarterly*, vol. 47, pp. 31-69, Mar 2002.
- [29] M. Godet, R. Monti, and F. Roubelat, *Manuel de prospective stratégique - 1. Une indiscipline intellectuelle*. Paris: Dunod, 2004.
- [30] A. Kinra and H. Kotzab, "A macro-institutional perspective on supply chain environmental complexity," *International Journal of Production Economics*, vol. 115, pp. 283-295, Oct 2008.
- [31] H. Mintzberg, "Rethinking strategic planning part I: Pitfalls and fallacies," *Long Range Planning*, vol. 27, pp. 12-21, 1994.
- [32] C. W. Roney, "Intersections of Strategic Planning and Futures Studies: Methodological Complementaries," *Journal for Futures Studies*, vol. 15, pp. 71-100, 2010.
- [33] Q. N. Huy and H. Mintzberg, "The rhythm of change," *Mit Sloan Management Review*, vol. 44, pp. 79-84, Sum 2003.
- [34] H. Mintzberg and B. W. Ahlstrand, *Strategy Safari - your complete guide through the wilds of strategic management*. Harlow, England: Prentice Hall, 2009.
- [35] H. Mintzberg, "Rethinking Strategic-Planning part II: new roles for planners," *Long Range Planning*, vol. 27, pp. 22-30, Jun 1994.
- [36] M. E. Porter, *Competitive strategy : techniques for analyzing industries and competitors*. New York:

- Free Press, 1980.
- [37] A. Osterwalder and Y. Pigneur, *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. Hoboken: John Wiley & Sons, 2010.
- [38] L. Konnertz, R. Rohrbeck, and S. Knab, "How Collaborative Business Modeling Can Be Used to Jointly Explore Sustainability Innovations," in *ISPIM Annual Conference Hamburg*, Germany, 2011.
- [39] R. Adams, *The Successful Business Plan: Secrets and Strategies*, 4th ed. Palo Alto: The Planning Shop, 2003.
- [40] M. E. Porter, *Competitive Advantage*. New York: The Free Press, 1985.
- [41] S. Broring and L. M. Cloutier, "Value-creation in new product development within converging value chains - An analysis in the functional foods and nutraceutical industry," *British Food Journal*, vol. 110, pp. 76-97, 2008.
- [42] J. S. Ratcliffe, "Challenges for corporate foresight: towards strategic prospective through scenario thinking," *Foresight*, vol. 8, pp. 39-54, 2006.
- [43] M. Godet, "Future memories," *Technological Forecasting and Social Change*, vol. 77, pp. 1457-1463, 2010.
- [44] J. Coates, P. Durance, and M. Godet, "Strategic Foresight Issue: Introduction," *Technological Forecasting and Social Change*, vol. 77, pp. 1423-1425, 2010.
- [45] G. Burt, "Why are we surprised at surprises? Integrating disruption theory and system analysis with the scenario methodology to help identify disruptions and discontinuities," *Technological Forecasting and Social Change*, vol. 74, pp. 731-749, 2007.
- [46] G. Ringland, "The role of scenarios in strategic foresight," *Technological Forecasting and Social Change*, vol. 77, pp. 1493-1498, 2010.
- [47] M. Godet and F. Roubelat, "Creating the future: The use and misuse of scenarios," *Long Range Planning*, vol. 29, pp. 164-171, Apr 1996.
- [48] E. Lichtenthaler, "The choice of technology intelligence methods in multinationals: towards a contingency approach," *International Journal of Technology Management*, vol. 32, pp. 388-407, 2005.
- [49] K. M. Patton, "The role of scanning in open intelligence systems," *Technological Forecasting and Social Change*, vol. 72, pp. 1082-1093, 2005.
- [50] M. L. Neugarten, "Foresight--Are we looking in the right direction?," *Futures*, vol. 38, pp. 894-907, 2006.
- [51] S. Mendonca, M. P. E. Cunha, F. Ruff, and J. Kaivo-oja, "Venturing into the Wilderness Preparing for Wild Cards in the Civil Aircraft and Asset-Management Industries," *Long Range Planning*, vol. 42, pp. 23-41, Feb 2009.
- [52] J. O. Schwarz, "Assessing the future of futures studies in management," *Futures*, vol. 40, pp. 237-246, 2008.
- [53] S. Mendonca and B. Sapio, "Managing foresight in changing organisational settings: introducing new perspectives and practices," *Technology Analysis & Strategic Management*, vol. 21, pp. 285-289, 2009/04/01 2009.
- [54] R. Rohrbeck, "Exploring value creation from corporate-foresight activities," *Futures*, vol. forthcoming, 2011.
- [55] N. Thom, "Measuring the value contribution of corporate foresight," presented at the 3rd ISPIM Innovation Symposium, Quebec City, Canada, 2010.
- [56] M. Gruber and C. Venter, "„Die Kunst, die Zukunft zu erfinden“ – Theoretische Erkenntnisse und empirische Befunde zum Einsatz des Corporate Foresight in deutschen Großunternehmen," *Zeitschrift für betriebswirtschaftliche Forschung (zfbf)*, vol. 2006, pp. 958-984, 2006.
- [57] R. Vecchiato and C. Roveda, "Foresight in corporate organisations," *Technology Analysis & Strategic Management*, vol. 22, pp. 99-112, 2010/01/01 2009.
- [58] R. Rohrbeck, "Harnessing a network of experts for competitive advantage - Technology Scouting in the ICT Industry," *R & D Management*, vol. 40, pp. 169-180, 2010.
- [59] M. Veugelers, J. Bury, and S. Viaene, "Linking technology intelligence to open innovation," *Technological Forecasting and Social Change*, vol. 77, pp. 335-343, 2010.
- [60] I. H. Ansoff, "Managing Strategic Surprise by Response to Weak Signals," *California Management Review*, vol. 18, pp. 21-33, 1975.
- [61] F. Madjdi and S. Huesig, "The Heterogeneity of Incumbents' Perceptions and Response Strategies in the Face of Potential Disruptions," *Foresight*, vol. 13, 2011.
- [62] C. Battistella and A. F. De Toni, "A methodology of technological foresight: A proposal and field study," *Technological Forecasting and Social Change*, vol. 78, pp. 1029-1048, 2011.
- [63] B. E. Flores and E. M. White, "A Framework for the Combination of Forecasts," *Journal of the Academy of Marketing Science*, vol. 16, pp. 95 - 103, 1988.
- [64] J. S. Armstrong, "The Ombudsman - Research on Forecasting - A Quarter-Century Review, 1960 - 1984," *Interfaces*, vol. 16, pp. 89-103, 1986.

- [65] G. Dryample, "Sales Forecasting Practices," *International Journal of Forecasting*, vol. 3, pp. 379 - 391, 1987.
- [66] R. Fildes, "Efficient Use of Information of Subjective Forecasts," *Journal of Forecasting*, vol. 10, pp. 597 - 617, 1991.
- [67] W. Ulrich, *Critical Heuristics of Social Planning*. New York: John Wiley & Sons, 1983.
- [68] R. T. Clemen, "Combining Forecasts: A Review and Annotated Bibliography," *International Journal of Forecasting*, vol. 5, pp. 559 - 583, 1989.
- [69] M. Mackay and M. Metcalfe, "Multiple method forecasts for discontinuous innovations," *Technological Forecasting and Social Change*, vol. 69, pp. 221-232, 2002.
- [70] M. Morrison and M. Metcalfe, "Is Forecasting a Waste of Time?," *Journal of General Management*, vol. 22, pp. 28 - 34, 1996.
- [71] H. Linstone, *Multiple Perspectives for Decision Making: Bridging the Gap Between Analysis and Action*. New York: John Wiley & Sons, 1984.
- [72] F.-M. Tseng, A.-C. Cheng, and Y.-N. Peng, "Assessing market penetration combining scenario analysis, Delphi, and the technological substitution model: The case of the OLED TV market," *Technological Forecasting and Social Change*, vol. 76, pp. 897-909, 2009.
- [73] A. Kameoka, Y. Yokoo, and T. Kuwahara, "A challenge of integrating technology foresight and assessment in industrial strategy development and policymaking," *Technological Forecasting and Social Change*, vol. 71, pp. 579-598, Jul 2004.
- [74] R. Rohrbeck and N. Thom, "Strategic Foresight," in *Applied Technology and Innovation Management*, A. H., M. Erner, P. Möckel, and C. Schläffer, Eds., ed Berlin Heidelberg: Springer, 2010.
- [75] R. Wells, R. Phaal, C. Farrukh, and D. Probert, "Technology Roadmapping for a Service Organization," *Research Technology Management*, vol. 47, pp. 46-51, Mar/Apr 2004.
- [76] S. A. W. Drew, "Building Technology Foresight: Using Scenarios to Embrace Innovation," *European Journal of Innovation Management*, vol. 9, pp. 241 - 257, 2006.
- [77] F. Lizaso and G. Reger, "Scenario-Based Roadmapping - A Conceptual View," presented at the EU-US Scientific Seminar on New Technology Foresight, Forecasting and Assessment Methods, 2004.
- [78] I. J. Petrick and A. E. Echols, "Technology roadmapping in review: A tool for making sustainable new product development decisions," *Technological Forecasting and Social Change*, vol. 71, pp. 81-100, 2004.
- [79] K. Casier, B. Lannoo, J. Van Ooteghem, S. Verbrugge, D. Colle, M. Pickavet, and P. Demeester, "Adoption and pricing: The underestimated elements of a realistic IPTV business case," *IEEE Communications Magazine*, vol. 46, pp. 112-118, Aug 2008.
- [80] J. Bryant and M. B. Oliver, *Media Effects - Advances in Theory and Research*, 3rd Edition ed. New York: Routledge, 2008.
- [81] M. Inouyem, "The "Audience of One": Long-Form Mobile and Portable Content Slowly Emerges," In-Stat, 2006.
- [82] S. Latré, N. Staelens, P. Simoens, B. De Vleeschauwer, W. Van de Meerssche, F. De Turck, B. Dhoedt, P. Demeester, and S. Van den Berghe, "On-line estimation of the QoE of progressive download services in multimedia access networks," in *Proceedings of ICOMP2008, the 2008 International Conference on Internet Computing*, 2008, pp. 181 - 187.
- [83] S. Van den Berghe and S. Latré, "QoE-driven Broadband Access," presented at the 2008 NEM Summit "Towards Future Media Internet", 2008.
- [84] Commission of the European Communities, "Communication on future networks and the internet," in *COM(2008) 594*, ed, 2008.
- [85] M. Fijnvandraat and H. Bouwman, "Flexibility and broadband evolution," *Telecommunications Policy*, vol. 30, pp. 424-444, 2006.
- [86] T. Monath, N. K. Elnegaard, P. Cadro, D. Katsianis, and D. Varoutas, "Economics of fixed broadband access network strategies," *Ieee Communications Magazine*, vol. 41, pp. 132-139, Sep 2003.
- [87] N. Degrande, K. Laevens, D. De Vleeschauwer, and R. Sharpe, "Increasing the user perceived quality for IPTV services," *IEEE Communications Magazine*, vol. 46, pp. 94-100, Feb 2008.
- [88] N. M. Jakopin, "Internationalisation in the telecommunications services industry: Literature review and research agenda," *Telecommunications Policy*, vol. 32, pp. 531-544, 2008.
- [89] H. L. van Kranenburg and J. Hagedoorn, "Strategic focus of incumbents in the European telecommunications industry: The cases of BT, Deutsche Telekom and KPN," *Telecommunications Policy*, vol. 32, pp. 116-130, 2008.
- [90] C. Bezold, "Lessons from using scenarios for strategic foresight," *Technological Forecasting and Social Change*, vol. 77, pp. 1513-1518, 2010.
- [91] H. C. Lucas and J. M. Goh, "Disruptive technology: How Kodak missed the digital photography revolution," *Journal of Strategic Information Systems*, vol. 18, pp. 46-55, 2009.
- [92] J. Arcade, M. Godet, F. Meunier, and F. Roubelat, "Structural Analysis with the MICMAC Method &

- Actors' Strategy with MACTOR Method," in *Futures Research Methodology*, J. Glenn, Ed., ed Washington, D.C.: American Council for the United Nations University: Millenium Project, 1999, pp. 1 - 69.
- [93] M. Godet, "The art of scenarios and strategic planning: Tools and pitfalls," *Technological Forecasting and Social Change*, vol. 65, pp. 3-22, Sep 2000.
- [94] R. Rohrbeck, M. Döhler, and H. Arnold, "Creating growth with externalization of R&D results - the spin-along approach," *Global Business and Organizational Excellence*, vol. 28, pp. 44-51, 2009.

---

<sup>i</sup> Tobias Heger is research associate at the Chair for Innovation Management and Entrepreneurship of the University of Potsdam and project manager at the innovation management unit of the European Center for Information and Communication Technology (EICT). His research interests are market exploration, collaborative innovation and innovation networks as well as innovation in information and communication technologies.

<sup>ii</sup> René Rohrbeck is Associate Professor for Strategy. His research interests are organizational change, strategy as practice, innovation management and organizational future orientation. His research has been published in *R&D Management*, *Technology Analysis & Strategic Management*, *Futures*, *Technological Forecasting and Social Change* and in several books, including "Corporate Foresight: Toward a Maturity Model for the Future Orientation of a Firm".

René Rohrbeck has 6 years of practical experience in the ICT and automotive industry, where he worked at Deutsche Telekom and Volkswagen on strategic management, innovation management and corporate foresight. In addition he has served as consultant for various companies in the ICT, automobile, luxury goods and energy industry.