Innovation instruments for translating future insights into managerial actions

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Abstract: One of the challenges in innovation management is managing uncertainty. Most industries repeatedly face disruptions coming from emerging technologies, political and legislative regulation, alternative business models, as well as from socio-cultural shifts. Continuous scanning and monitoring of a company's environment can contribute to reducing uncertainty. Corporate foresight activities address these dynamics and many methods and tools for collection and interpretation of information are known. But the utilization of this information remains a weakness of many companies. Foresight and innovation management literature has repeatedly lamented the failure of translating future insights into managerial actions and thus boosting a firm's ability to adapt to a changing environment.

Based on case studies in various industries three major instruments have been identified to cope with this problem and are presented in this paper on the example of Deutsche Telekom.

Keywords: innovation management; corporate foresight; technology scouting; roadmapping; Enterprise 2.0

1 Introduction

The basis for successfully managing changing environments is to anticipate these changes. But anticipation must also be linked to planning appropriate reactions[1]. Being aware of discontinuous technological change alone does not ensure that the company will be able to produce adequate reactions. Recent examples of failure to adapt to changes in the environment of industry-dominating players such as Kodak or Siemens emphasize the need to install an actionable future outlook[2]. In both cases: (1) Kodak which was hit by the shift to digital photography and (2) Siemens which failed to stay competitive in an increasingly mobile telecommunication industry, the external change was detected. But both companies failed to respond to the external change comprehensively enough and fast enough to avoid failure.

Based on 18 recent case studies in different industries complemented by a benchmarking study with 83 participating companies best practices of corporate foresight have been identified[3]. A key finding of these studies has been that many companies already have strong competences in collecting and interpreting information, but show weaknesses in successfully disseminating and using the gained insights. Only 23% of the respondents to the benchmarking study consider themselves as communicating important information to decision makers effectively. The study also revealed that participation of all employees in foresight is desirable, which is only the case though at 18% of the responding companies.

The areas for benchmarking (see Table 1) have been defined in a framework building on the 18 case studies[4]. According to this framework successful corporate foresight – and hence making use of the gained insights from foresight – depends on capabilities such as *culture* (e.g. willingness to share), *organization* (e.g. integration of foresight activities within processes of innovation management or strategic management), *method sophistication* (e.g. integration capacity), *information usage* (e.g. sources and scope), and *people & networks* (especially the internal communication and the use of internal and external networks). Value is only created, when insights are turned into action and output, such as enhanced reaction to opportunities and threats, reduced uncertainty and successful innovations.

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[1] Krystek, U., & Müller-Stewens. 1993. ***Frühaufklärung für Unternehmen: Identifikation und Handhabung zukünftiger Chancen und Bedrohungen***. Stuttgart: Schäffer-Poeschel, Liebl, F. 1996. ***Strategische Frühaufklärung : Trends - issues - stakeholders***. München, Wien: Oldenbourg.

[2] Lucas, H. C., & Goh, J. M. 2009. Disruptive technology: How Kodak missed the digital photography revolution. ***Journal of Strategic Information Systems***, 18(1): 46-55.

[3] Rohrbeck, R. forthcoming. ***Corporate Foresight – Towards a Maturity Model for the Future Orientation of a Firm***. Heidelberg and New York: Physica Verlag Springer-Verlag GmbH & Co.KG, Rohrbeck, R., & Gemünden, H. G. 2009. Analyse des Reifegrades Strategischer Frühaufklärungssysteme in multinationalen Unternehmen. In M. Reimann, & S. Fiege (Eds.), ***Perspektiven des Strategischen Controllings: Festschrift für Professor Dr. Ulrich Krystek***: Gabler, Rohrbeck, R., Mahdjour, S., Knab, S., & Frese, T. 2009. Benchmarking Report: Strategic Foresight in Multinational Companies: European Corporate Foresight Group.

[4] Rohrbeck, R. forthcoming. ***Corporate Foresight – Towards a Maturity Model for the Future Orientation of a Firm***. Heidelberg and New York: Physica Verlag Springer-Verlag GmbH & Co.KG.

Table 1 Benchmarking areas

Benchmarking area	*Description*
Information Usage	Where and how do companies search for future-oriented information?
Method Sophistication	Which methods are applied for anticipation of future developments and how do companies choose these methods?
People & Networks	What are characteristics of foresighters and how are insights from foresight disseminated und used within companies?
Organization	How and where within companies are foresight activities started and how are these activities linked to other organizational units?
Culture	How supportive is the corporate culture towards foresight activities?

Source: (Rohrbeck et al., 2009)

One participant in both, case and benchmarking study, was the telecommunication provider Deutsche Telekom, which also has foresight instruments in place that have proven to successfully identify developments and trends in their technological, consumer, and competitive environment[5]. Still the benchmarking with other multinationals revealed room for improvement in the dissemination and utilization of insights, mainly due to barriers coming from the areas of *culture*, *people & networks* and partly for reasons in *organization*. In order to tackle these barriers, best practices of other case study participants have been discussed and translated to the context of Deutsche Telekom. Three instruments have been identified and initiated, in order to enhance dissemination and utilization of insights from the technology foresight activity 'Deutsche Telekom Technology Radar':

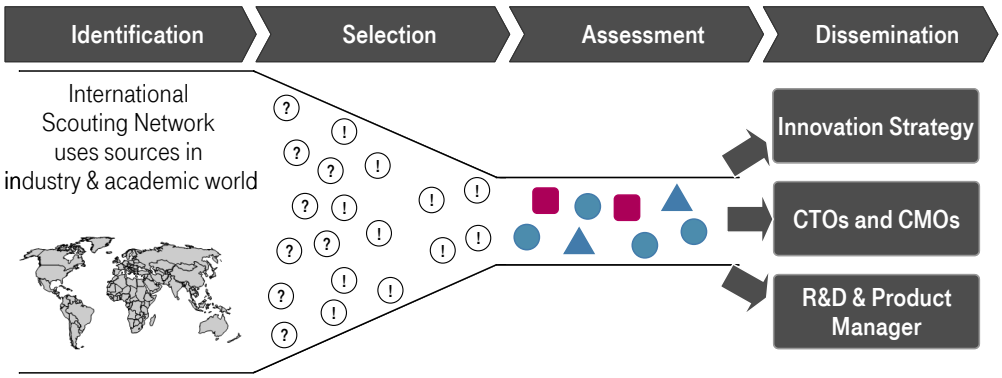
- An *interactive IT-based platform* to facilitate a strategic discussion among foresighters and internal stakeholders (addressing *people & networks*)
- Future outlook *round tables* to create a big picture by integrating foresight insights from market and technology perspective (addressing *culture*)
- *Joint roadmapping* between foresighters, R&D and business units to map emerging technologies to business needs and facilitate a two-way gap analysis to identify what R&D needs to work on and what products can be realized with existing and emerging technologies (addressing *organization*)

[5] Rohrbeck, R., & Thom, N. 2010. Strategic Foresight. In H. Arnold, M. Erner, P. Möckel, & C. Schläffer (Eds.), ***Applied Technology and Innovation Management***, 1 ed. Berlin: Springer, Thom, N., & Rohrbeck, R. 2009. Technology Foresight in the ICT Sector – Exploration of new business opportunities, ***2nd ISPIM Innovation Symposium***. New York.

2 Deutsche Telekom Technology Radar

Technology foresight includes the identification of technological developments and trends, the assessment of their impact, as well as storage and dissemination of the created insights[6]. Accordingly the process of the technology foresight instrument 'Deutsche Telekom Technology Radar' consists of four steps (see Figure 1).

Figure 1 Deutsche Telekom Technology Radar process



Identification of technological developments and trends at Deutsche Telekom is particularly based on an international network of technology scouts. They gather first-hand information through their personal networks in industry and academia and send it in the form of topic proposals to the responsible of the Technology Radar. In the *selection* phase experts assess these technological topics according to their newness to Deutsche Telekom and their innovative character. From the long-list of topic proposals only those are selected that need to be reported to people responsible for decision-making or implementation. The expert panel consists of colleagues from corporate R&D, corporate innovation strategy and representatives of all strategic business fields. In the assessment phase the selected topics are further classified concerning their need for awareness. The criteria 'market potential' and 'technological realization complexity' is used in order to rank technologies with a 'high', 'medium', or 'low' need for awareness, thus enabling the information user to prioritize and filter. In the *dissemination* phase a one-pager of each technology is published including a description, latest developments, research status and a discussion of the business potential. The collection of one-pagers is supplemented by a management summary and feature papers describing broader trends in detail. All documents are made available through an email distribution list, the intranet and printed copies for executives.

[6] Ashton, W. B., & Stacey, G. S. 1995. Technical intelligence in business: Understanding technology threats and opportunities. ***International Journal of Technology Management***, 10(1): 79-104.

3 Utilization of insights from foresight

While the methods and tools used for identification, selection and assessment of information have proven to be successful, the dissemination and subsequently the utilization of the information left potential for improvement. Best practices at other companies inspired the introduction of three major instruments for giving access to the information, putting it into context and responding to it.

Interactive IT-based platform

IT tools in the form of databases, software or Web services have found their way into all areas of business and private life and mostly for good. Also applied to foresight it is believed that using such tools has a positive influence on efficiency and effectiveness[7]. IT tools support the collection of information, but also provide means of information sharing, coordination, and collaboration[8]. This is particularly useful, because joint interpretation, enhances the ability to see complex patterns and motivates participants to commit to common projects[9].

Today an increasing number of applications and services are web-centric. In an own analysis of successful web services emerging in recent years, most of these services appeared to be in the area of productivity and collaboration. Such services suit current trends in our working environment, where much is project-based involving different business units and external support located all over the world. Web-based productivity and collaboration tools allow collaboratively working on documents which are stored and managed online. Furthermore, the research and management activities of Deutsche Telekom, set in an open innovation environment, demand for sharing information resources and opinions. Bookmarking tools that allow to highlight, to recommend, but also to annotate information are most useful in this sense. Messaging and microblogging solutions enable faster communication. Finally, social networking features have found their application in the enterprise. Profile information such as expertise and contact details is useful to identify and contact persons for certain purposes.

For a long time, distributing the Technology Radar relied on an email distribution list and a circle of decision makers within the group who would receive reports in printed form. While subscription requests to the distribution list indicated a growing interest in the information, and occasional feedback suggested that the information was actually being used, there was no way of telling to which extend information was used, if it matched the information needs of users and if it reached through to those in need. The introduction of an intranet website allowed for more exposure of the Technology Radar

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[7] Rohrbeck, R. forthcoming. ***Corporate Foresight – Towards a Maturity Model for the Future Orientation of a Firm***. Heidelberg and New York: Physica Verlag Springer-Verlag GmbH & Co.KG, Zhang, M. J., & Lado, A. A. 2001. Information systems and competitive advantage: a competency-based view. ***Technovation***, 21(3): 147-156.

[8] Zhang, M. J., & Lado, A. A. 2001. Information systems and competitive advantage: a competency-based view. ***Technovation***, 21(3): 147-156.

[9] Adamides, E. D., & Karacapilidis, N. 2006. Information technology support for the knowledge and social processes of innovation management. ***Technovation***, 26(1): 50-59, Rothwell, R. 1992. Successful Industrial-Innovation - Critical Factors for the 1990s. ***R & D Management***, 22(3): 221-239.

to potentially all employees and for better linking information and contacts. Still it didn't provide the interactivity needed for feedback and, more importantly, involvement of users in topic identification and assessment. Also possibilities for the user to manage the information were still limited. A smarter solution was needed to provide all the missing functions. With the main focus being the benefit for the individual user, a new intranet solution has been developed incorporating interactive features such as those mentioned above. The main components and functionalities are presented in the following.

A *database* is the core of the platform and serves all process steps of the Technology Radar. All topics identified by the technology scouts are submitted to the database as an initial point for a workflow. Experts are assigned in order to start the selection process. Decisions about selection as well as the assessment of the need for awareness are added as status information of each topic. After creating one-pagers of the selected technologies, all information can be pushed directly to an intranet website. The database replaces a number of spreadsheets, inefficient email communication and manual work. It increases the efficiency of the production process, but also enables easier involvement of scouts and experts. Furthermore, enhanced analyses about incoming trends and their history can be accomplished easily.

With technological descriptions (one-pagers) being the core content of the Technology Radar, a second key element of the platform are *article pages*. These pages contain a description, latest developments, research status and a discussion of the business potential – just like the offline version. The offline version is excelled though by web functionalities such as search, recommendation, bookmarking, tagging, etc. thus enabling an increased user experience and usability.

The *tagging* functionality is serving several purposes: By annotating articles with keywords (tags), more possibilities for searching for – and hence finding – information are given. Moreover, by allowing users to provide own tags on top of those pre-defined by the author, the users can enrich the information with their own perspective and taxonomy. The possibility to translate information to issues of importance for the user is crucial for the information being used at all. Finally, by analyzing the use of keywords and their variation over time conclusions can be drawn concerning the importance of certain topics.

Not only can users tag article pages, they can also set *bookmarks*. The main purpose is making it easier for users to repeatedly access information useful for them via a personalized 'my bookmarks' box. In addition, analyzing which topics are bookmarked most often indicates the importance of these topics.

Providing a *search* functionality is another benefit of web technology. Search can be performed on full text, but also on tags. The personalized 'my tags' box allows for a one-click search for keywords of interest and as a result provides a list of articles sorted by relevance regarding the tag.

Finding information of relevance beyond search is enabled by *recommendation* mechanisms. On the one hand, article pages are automatically analyzed, and within the page links to related articles are presented. On the other hand, users can forward articles to colleagues, if they feel these colleagues should have (and use) this information.

Similar to the tagging function, a *watchlist* allows the user to define keywords. As soon as new information is submitted to the platform containing the keyword, an email notification is sent to the user.

Table 2 Key elements of interactive platform

Element	*Description*
Database	Central entity for gathering and processing information
Article pages	Display of technological descriptions including meta data on importance, contact information and means for interaction
Tagging	Functionality for matching information with keywords
Bookmarking	Functionality for marking favourite article pages
Search	Possibility to search in article pages and over tags, resulting in list of suitable article pages
Recommendation	Suggestion of related article pages within on article and option to forward information to colleagues
Watchlist	Feature for defining keywords in order to receive Email notification on new information containing that keywords
Comments	Possibility to comment article pages and comments of other users
Rating	Rating feature allows to assess the importance of provided information from the users' perspective
Analytics	Overview of 'best rated', 'most discussed' and 'most bookmarked' article pages
Topic proposals	Option for users to suggest own technological topics for further coverage

The user has not only possibilities of personalization, but also for more direct interaction. One means is the *commenting* function. Users can comment on article pages giving their opinion or asking questions. Others can reply to comments or just follow the discussion. Analyzing the frequency of discussions again can reveal topics of interest and importance.

Another means is the *rating* function. Users can assess the importance of the described technology on a five point scale spanning from 'not relevant' to 'very relevant'. The aggregated user ratings, together with statistics on the number of comments, bookmarks and recommendations, are displayed on top of the article page.

A very important means of interaction is the possibility for users to make own *topic proposals*. While technology scouting is the main source of the Technology Radar, it can only be successful if it matches the information needs. Users' topic proposals complement information identified by scouting and give additional guidance to the scouts concerning the search fields.

Finally, users have access to selected *analyses*. They can search for potentially important topics by selecting the 'best rated', 'most bookmarked' or 'most discussed' article pages from the menu.

The described functionalities are rather simple and widely known. But in their combination they achieve something important: making the discovery and use of relevant information easy for the user. In the end, for the success of such a platform the

participation of users is essential. While an increased efficiency in gathering, processing and communicating information was visible immediately, the effectiveness was not granted. A benefit perceived by the user is a key requirement. The continuous management of the growing community (including response to and communication with the stakeholders) and the provision of additional instruments for follow-ups are further precursors of effective corporate foresight.

Round tables

Another requirement for effective foresight is sharing of the identified information and its acceptance by the addressed user. This requires the participation of internal customers and decision makers[10]. Moreover, it is necessary to integrate the insights from technology foresight with the market perspective[11]. Both can be accomplished by bringing together foresighters with each other as well as with their internal customers. At Deutsche Telekom round tables have been introduced as the instrument of choice. These round tables take place on two different levels of the organization: (1) on the level of corporate R&D, where insights from technology foresight are matched with current R&D activities and (2) on the corporate level where insights from technology foresight are matched with insights from consumer foresight, market research and corporate strategy.

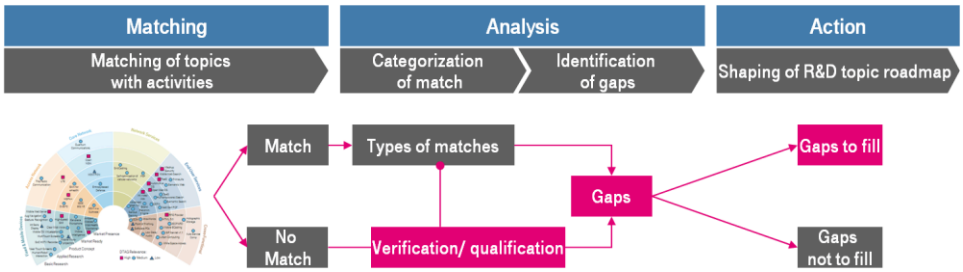
The corporate R&D unit of Deutsche Telekom (Deutsche Telekom Laboratories) is organized into five major innovation fields covering all aspects of ICT. Each innovation field consists of several project fields. Regular meetings of project field leaders from each innovation field take place for coordinating activities. Three times a year the Technology Radar responsible takes part in one meeting with each innovation field to discuss scouting results on new technological developments and trends. These discussions inspire new R&D activities by revealing potential gaps, but also challenging existing R&D activities by introducing alternative technological solutions.

Table 3 Categories for matching R&D activities with technology foresight

Category	*Description*
Match	Covered by project to large extent *or* Covered by project in (recognizable) parts
Weak match	Covered by project, but not focused *or* Same use case/ scenario covered in project but different approach/ technology *or* Covered by project field, but not focused
No match	No match (not necessarily a gap)

[10] Cuhls, K. 2003. From forecasting to foresight processes - New participative foresight activities in Germany. *Journal of Forecasting,* 22**,** 93-111, Salo, A. A. 2001. Incentives in technology foresight. *International Journal of Technology Management,* 21**,** 694-710.
[11] Rohrbeck, R., Arnold, H. M., & Heuer, J. 2007. Strategic Foresight in multinational enterprises – a case study on the Deutsche Telekom Laboratories, ***ISPIM-Asia 2007***. New Delhi.

Figure 2 Matching of technology foresight with R&D activities



Each technological topic proposed by the scouting network is matched to the activities of the respective innovation field using three different categories (see Table 3). A 'match' of a new technology with existing activities would indicate being on the right track with no need for further action. A 'weak match' indicates the existing awareness of the new technology and its application to a certain extend. Weak matches are further verified regarding being a gap or not. Finally the category 'no match' describes the deliberate or undeliberate non-application of a technology and also involves verification of potentially existing gaps. As a result every innovation field has a basis for further decisions. For example, identified gaps could lead to new project proposals in the stage-gate-process. Identified more promising alternatives to used technologies could lead to re-shaping existing activities, thus increasing the likelihood of successful project results.

On the corporate level, round tables are composed of representatives from technology foresight (the Technology Radar), consumer foresight, competitor foresight, market research as well as innovation strategy, technology strategy, and marketing strategy. The round table takes place twice a year and aims at aligning technology and market (consumers, competitors) perspective, in order to create a consistent 'big picture'. Moreover, the involvement of strategists allows matching technology and market trends with existing strategies. Thus, means for achieving strategic goals are identified, but also input for reshaping the strategy is given where required. Alignment of the different perspectives is achieved by building clusters. Foresighters present latest developments and formulate trends from their own perspective. Trends from different perspectives, for example the growing importance of ethics and ecology among consumers and new technological solutions for energy efficiency, are matched and related to trend clusters, e.g. sustainability. Afterwards, concerned departments are identified (Who should know about it?), implications are drawn (What are the opportunities or threats?) and scenarios created in order to decide about possible responses to identified developments and trends. At a dedicated event all trend clusters, example trends, implications and scenarios are presented to an audience of R&D and product managers, strategists and executives from all over Deutsche Telekom. Finally, following the presentations group discussions on every trend cluster take place involving the participants of the event. The results from round tables and discussions during the event are used as a basis for decision-making and 'top topics' are put directly on the agenda of innovation responsible.

Both types of round tables, those on the corporate R&D level and those on the corporate level, have two major advantages: (1) they create a common understanding of developments and trends, as well as their implications through direct interaction of

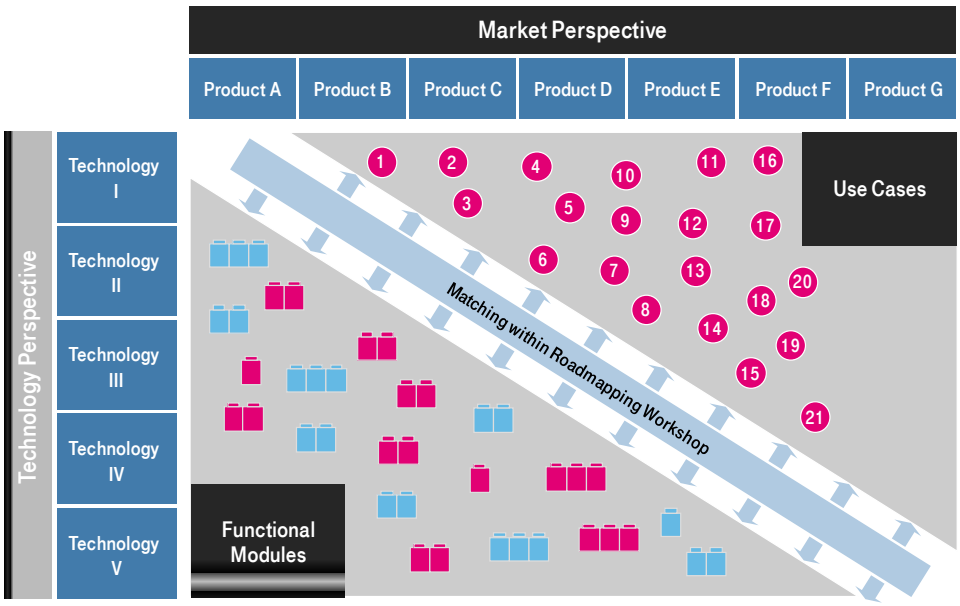
people and (2) they involve the information user in defining these implications and possible responses. Therefore, foresight results are effectively disseminated, but also the chance of acceptance of information is increased due to the participation of stakeholders in the process. Finally, the efforts from the round tables lead directly to activities such as R&D projects or product definitions.

Roadmapping

Usage of foresight results through roadmapping is the most structured of the three approaches. Roadmapping is a well-known planning method that allows matching consumer needs with technological capabilities in order to plan product evolution over time[12].

Figure 3 shows the general logic followed by roadmapping. On the left a number of technologies are expected to match with a number of products on the top. For matching, the products are decomposed into *use cases*, which describe the interaction logic of a consumer with a product in order to allow the identification of different solutions (thus different products) to fulfil the customer need. The technologies are decomposed into *functional modules*, which describe fine-grain operation which can be fulfilled by a technological solution.

Figure 3 Matching of technology foresight with R&D activities



In most companies matching of consumer needs with technologies is no straight forward exercise. It involves multiple stakeholder on both sides (marketing and R&D), is complex

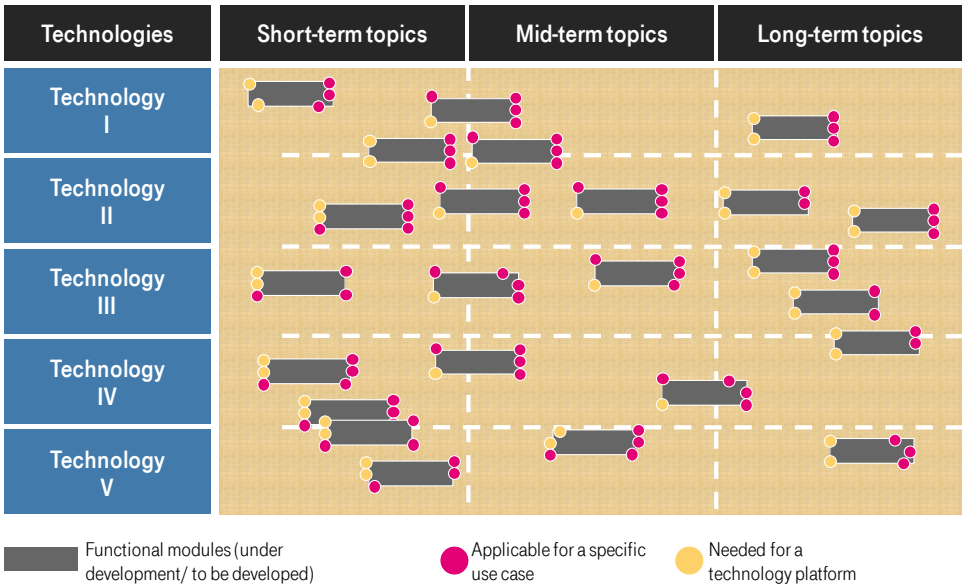
[12] Phaal, R., Farrukh, C. J. P., & Probert, D. R. 2004. Technology roadmapping - A planning framework for evolution and revolution. ***Technological Forecasting and Social Change***, 71(1-2): 5-26.

and often needs to cope with a high degree of uncertainty. Issues which are subject to uncertainty include: what technological option should be chosen, when will a certain technology be ready for deployment, what is the customer preference concerning technological options and most importantly, did we have all the options on the table.

At Deutsche Telekom foresight results are integrated into the roadmapping exercise, in order to extend the technological options that are available for matching, to challenge dominant logic and to generate early feedback on the applicability and utility of emerging technologies. For that purpose foresight results are translated into *functional modules* (representing emerging technologies) and *use cases* (representing consumer needs).

Figure 4 shows the primary workspace for a roadmapping workshop. In the roadmapping workshops functional modules (gray rectangles) are then presented by R&D project field managers and are marked by product managers as suitable for realization of a use case (magenta circles) or they are signalled by technology platform managers as needed for their platform (yellow circles).

Figure 4 Matching process within the roadmapping workshop



From a foresight perspective roadmapping exercises generate three major benefits:

- The potential applicability of emerging technologies is assessed
- Emerging technologies trigger discussions about new use cases and thus innovative products and services
- The matching of emerging technologies with new use cases allows generating product and service concepts for radical innovations (new market with new technology)

Maybe even more importantly roadmapping creates ownership by involving people who can later drive activities. On the basis of the matching process, people are identified for monitoring and potentially developing emerging technologies, for following up new use cases or developing new products and services.

4 Conclusion

From previous studies we have identified that translating weak signals on emerging change into managerial actions still poses a challenge for the majority of companies. While they have practices in place to alert them of emerging (disruptive) change, the organizational structure, the network of internal stakeholders and multiple managerial systems prevent the definition and execution of activities to proactively manage the change.

We then continued to describe three mechanisms that help to translate weak signals into action. IT-based platforms have the benefit of being scalable and able to manage a high number of relationships between signals for change and implications for the organization. Round tables have their strength in triggering creative thinking and facilitating strategic discussions. Roadmapping has been shown to directly influence R&D and product planning, thus also having the closest link to strategic and financial planning.

In our case studies we were able to mostly study pilot phases of these mechanisms, therefore the benefits have to be regarded as potential benefits. Follow up assessments need to evaluate if real value (in terms of new products and services that would not have been developed without them) is created.

References and Notes

Adamides, E. D., & Karacapilidis, N. 2006. Information technology support for the knowledge and social processes of innovation management. ***Technovation***, 26(1): 50-59.

Ashton, W. B., & Stacey, G. S. 1995. Technical intelligence in business: Understanding technology threats and opportunities. ***International Journal of Technology Management***, 10(1): 79-104.

Krystek, U., & Müller-Stewens. 1993. ***Frühaufklärung für Unternehmen: Identifikation und Handhabung zukünftiger Chancen und Bedrohungen***. Stuttgart: Schäffer-Poeschel.

Liebl, F. 1996. ***Strategische Frühaufklärung : Trends - issues - stakeholders***. München, Wien: Oldenbourg.

Lucas, H. C., & Goh, J. M. 2009. Disruptive technology: How Kodak missed the digital photography revolution. ***Journal of Strategic Information Systems***, 18(1): 46-55.

Phaal, R., Farrukh, C. J. P., & Probert, D. R. 2004. Technology roadmapping - A planning framework for evolution and revolution. ***Technological Forecasting and Social Change***, 71(1-2): 5-26.

Rohrbeck, R. forthcoming. ***Corporate Foresight – Towards a Maturity Model for the Future Orientation of a Firm***. Heidelberg and New York: Physica Verlag Springer-Verlag GmbH & Co.KG.

Rohrbeck, R., Arnold, H. M., & Heuer, J. 2007. Strategic Foresight in multinational enterprises – a case study on the Deutsche Telekom Laboratories, ***ISPIM-Asia 2007***. New Delhi.

Rohrbeck, R., & Gemünden, H. G. 2009. Analyse des Reifegrades Strategischer Frühaufklärungssysteme in multinationalen Unternehmen. In M. Reimann, & S. Fiege (Eds.), ***Perspektiven des Strategischen Controllings: Festschrift für Professor Dr. Ulrich Krystek***: Gabler.

Rohrbeck, R., Mahdjour, S., Knab, S., & Frese, T. 2009. Benchmarking Report: Strategic Foresight in Multinational Companies: European Corporate Foresight Group.

Rohrbeck, R., & Thom, N. 2010. Strategic Foresight. In H. Arnold, M. Erner, P. Möckel, & C. Schläffer (Eds.), ***Applied Technology and Innovation Management***, 1 ed. Berlin: Springer.

Rothwell, R. 1992. Successful Industrial-Innovation - Critical Factors for the 1990s. ***R & D Management***, 22(3): 221-239.

Thom, N., & Rohrbeck, R. 2009. Technology Foresight in the ICT Sector – Exploration of new business opportunities, ***2nd ISPIM Innovation Symposium***. New York.

Zhang, M. J., & Lado, A. A. 2001. Information systems and competitive advantage: a competency-based view. ***Technovation***, 21(3): 147-156.