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Integration of market pull and technology push in the corporate front end and innovation management—Insights from the German software industry

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Abstract

Within the framework of this paper, an extensive literature overview of technology and innovation management aspects on market pull and technology push will be given. The existing classification of market pull and technology push will be particularly shown and called into question by suggesting a conceptual framework. Additionally, the most common front end innovation models will be introduced. Finally, the authors will introduce how a technology-based service company is managing the connection of these two alternatives. A special focus will be laid on the accordant methods in order to search for current market needs and new related technologies. The selected case study will focus on one of Germany's biggest and most successful software development and information technology service providers. Based on interviews, document analysis, and practical applications, an advanced conceptual framework will be introduced as to how market pull and technology push activities within the corporate technology and innovation management can be integrated. Hence, the purpose of the paper is to introduce a theory-based conceptual framework that can be used in today's corporate environment. In this context, technology managers may use the results as a conceptual mirror, especially regarding the influencing factors of innovation impulses and the use of interdisciplinary teams (with people from inside and outside the company) to accomplish successful corporate technology and innovation management.

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Keywords: Idea management; Front end; Innovation management; Technology management; Innovation process; Market pull; Technology push; Software industry

1. Introduction and purpose

Organizations and businesses have recognized the need for finding new methods and paradigms to efficiently serve existing and new markets with new and/or modified products as well as services (Ansoff, 1965). Thus, the changing global environment is compelling organizations and businesses to permanently seek the most efficient models to maximize their innovation management efforts (Christiansen, 2000). As innovation is a responsibility of all business units and departments, their involvement needs to be determined accordingly (Tucker, 2002). In this context, an organization's ability to identify, acquire, and utilize (external) ideas can be seen as a critical factor in regards to

its market success (Zahra and George, 2002). This so-called 'Front-End of Innovation' is therefore one of the most important areas of corporate management.

Technology and technology-oriented companies, especially in the business-to-business area, are traditionally more influenced by new technologies than other companies. However, firms in the business-to-consumer sector focus more on end-users, and, therefore, market-induced impulses. The related scientific discussion regarding the 'right' innovation management and especially the 'best' source of innovation is similar to the question of whether the chicken or egg came first. The question becomes even more complex since there are several examples of successful technology-oriented companies as well as market-oriented ones. Therefore, the question is not which view is right or wrong, but if there is a practicable way to combine both views or even extend them to other related factors.

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Hence, the purpose of the paper is to introduce a theory-based conceptual framework that can be used in today's corporate environment. In order to achieve this, the related theoretical background (with a focus on the front end of innovation) is discussed, supplemented by a case study from the German software industry. Finally, the discussion and implication section summarizes and consolidates the findings of both parts with the introduction of

- different case-specific sources for innovation impulses,
- an extended conceptual framework for corporate innovation management and
- an advanced front-end innovation approach.

2. Theoretical background and literature review

2.1. Conceptual classifications

In order to build a common understanding of market pull and technology push activities, some fundamental considerations will be introduced.

Dealing with technology means to handle different stages of research and therefore special management duties and responsibilities (see Fig. 1).

According to Specht (2002), the stages of technology development and pre-development activities belong to technology management. The field of R&D management is determined by adding upstream fundamental research as well as product and process development. Finally, innovation management includes the product and market introduction phase. Thus, innovation management can be defined as 'a systematic planning and controlling process, which includes all activities to develop and introduce new products and processes for the company' (Seibert, 1998, p. 127) or, in short, the dispositive constitution of innovation processes (Hauschildt, 2004). Following Thom (1980), these innovation processes can be divided into the stages of 'idea generation', 'idea acceptance', and 'idea realization' (see Fig. 2).

Obviously, every innovation is based on an idea from inside or outside the company (Boeddrich, 2004). In order to obtain a maximum number of innovative product and

process ideas, a holistic view of the innovation process is needed. Hence, the basic approach of Thom (1980) is to collect as many promising ideas as possible; therefore, the determinations of the search fields are especially crucial to the whole innovation process. Search fields can be identified, for instance, by defining the individual user needs and the current product value (Burgelman et al., 2004). The idea acceptance phase consists of several stages through which the ideas have to pass and where they are enriched (Cooper, 2005). When realizing the selected ideas, it is important to choose efficient ways of saving resources (Aeberhard and Schreier, 2001). The final success of idea management strongly depends on the right process structure for the different kinds of ideas and the corresponding adequate organizational implementation (Voigt and Brem, 2005).

2.1.1. Fuzzy front end of innovation

For further consideration of the matter, the understanding of the front end of innovation (FEI) plays an important role. Therefore, FEI will be defined and some recent approaches will be introduced.

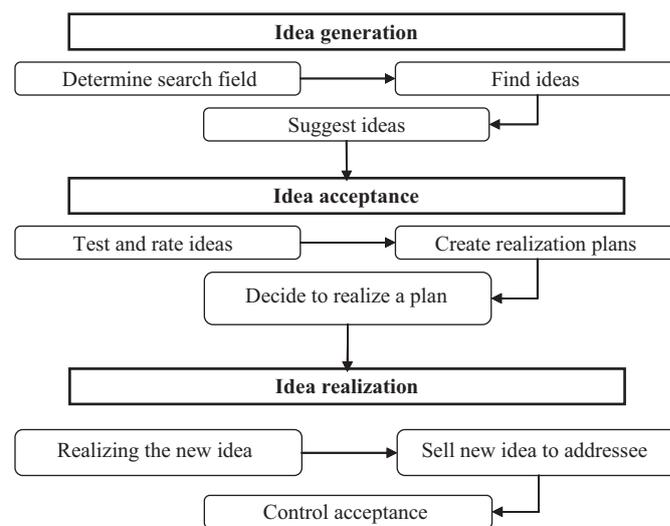


Fig. 2. Standardized stages of the corporate innovation process (Thom, 1980).

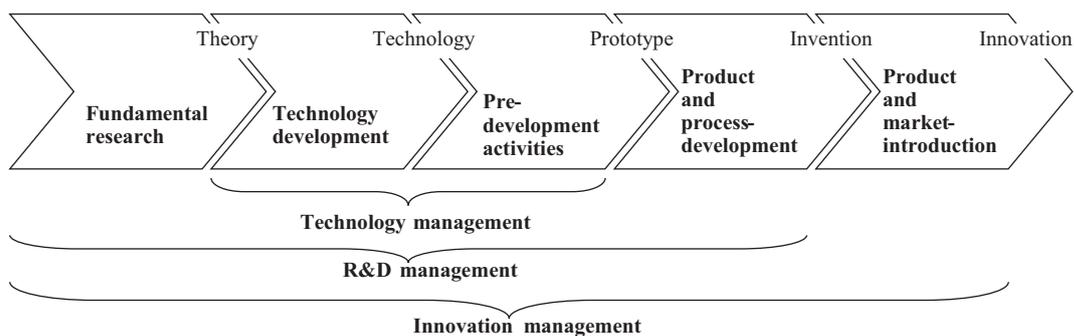


Fig. 1. Classification of technology, R&D and innovation management (Specht, 2002).

The term ‘(fuzzy) front end’ describes the earliest stage of an idea’s development and comprises the entire time spent on the idea, as well as activities focusing on strengthening it, prior to a first official discussion of the idea (Reid and de Brentani, 2004). Wellsprings for ideas have both internal and external sources (von Hippel, 1988). In this context, it is important to consider the differences of the new product and process development (see Table 1).

Furthermore, the terms ‘(fuzzy) front end’ and ‘front end innovation’ are synonymous. Following the argumentation of Koen et al. (2001) that this fuzziness implies an innovation process phase consisting of unknowable and uncontrollable factors, the term ‘front end innovation’ will

Table 1
Front end innovation vs. new product and process development (Koen et al., 2001)

	Front end of innovation	New product and process development
Nature of work	Experimental, often chaotic, difficult to plan, ‘eureka’ moments	Structured, disciplined, and goal-oriented with a project plan
Commercialization date	Unpredictable	Definable
Funding	Variable; in the beginning phase, many projects may be ‘bootlegged’, while others will need funding to proceed	Budgeted
Revenue expectations	Often uncertain, sometimes done with a great deal of speculation	Believable and with increasing certainty, analysis, and documentation as the release date gets closer
Activity	Both individual and team-oriented in areas to minimize risk and optimize potential	Multi-functional product and/or process development teams

be the sole one used in this paper. In this sense, the phase is partly analog to the introduced idea generation stage, but the focus on the front end is mainly one of opportunity identification and analysis (Belliveau et al., 2004; Khurana and Rosenthal, 2002). Therefore, the front end is one of the greatest areas of weakness of the innovation process and fundamentally determines the later innovation success (Koen et al., 2001). It will come as no surprise, then, that effective management of the front end results is a sustainable competitive (innovation) advantage. Surprisingly, there has been little research done on the issue thus far (Kim and Wilemon, 2002).

A flow-oriented approach, the so-called ‘idea tunnel’, which resulted from an older concept called ‘development funnel’ (Hayes et al., 1988), is the elementary basic model for front end considerations (see Fig. 3).

Hence, there are two ways of gaining ideas: one, collecting them in a sense that they are already present somehow (at least in the mind of a person or group), or two, generating them through a well thought-out process utilizing creative methods. Consequently, creative practice methods and techniques are needed to foster a continuous spirit of creative evolution (Kelley and Littman, 2005). Key elements for promoting corporate creativity include a motivating reward system, officially recognized creativity initiatives, the encouragement of self-initiated activities, and the allowance of redundancy (Stenmark, 2000).

Nevertheless, several general requirements must be fulfilled in order to generate ideas that will be successful in the marketplace (Boeddrich, 2004):

- a consideration of the company’s corporate strategy,
- obvious benefits for the ideas’ target audience and
- a systematically structured and conducted concept-identification phase.

Moreover, there are not only general, but also company-specific ramifications to consider, which increase the

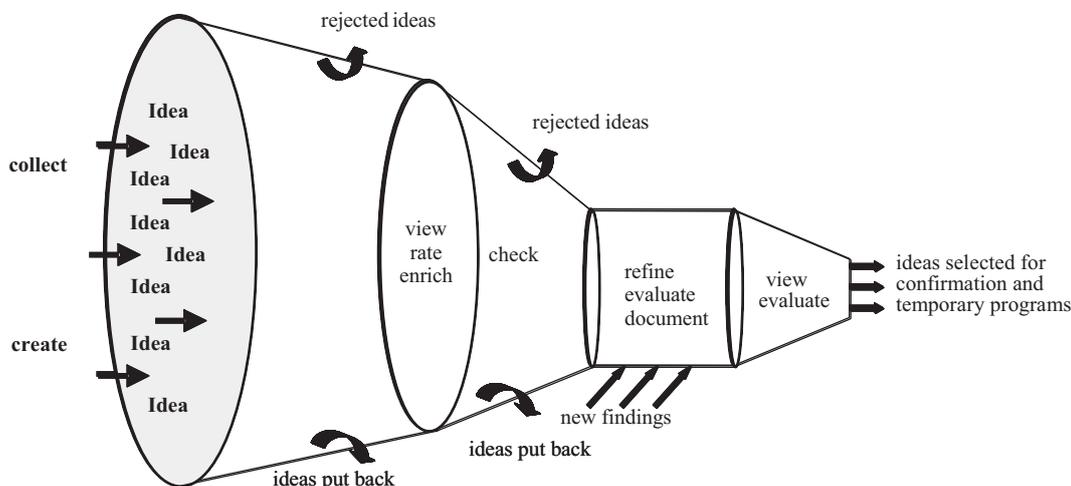


Fig. 3. The idea tunnel (Deschamps et al., 1995).

situation's complexity (Boeddrich, 2004). That is why there is always a dilemma between giving the front end a certain system and structure on one hand, and forcing creativity (as well as implementing externals) on the other hand.

Due to page restrictions, the following list of FEI models is not exhaustive, but gives an overview of existing approaches with different focuses.

The most popular one is the new concept development model from Koen et al. (2001), which is supposed to provide a common language for front end activities (see Fig. 4).

The circular shape shows the flow, circulation, and iteration of ideas within the five core elements and surrounding (external) influencing factors. A fundamental distinction is made between an opportunity and an idea:

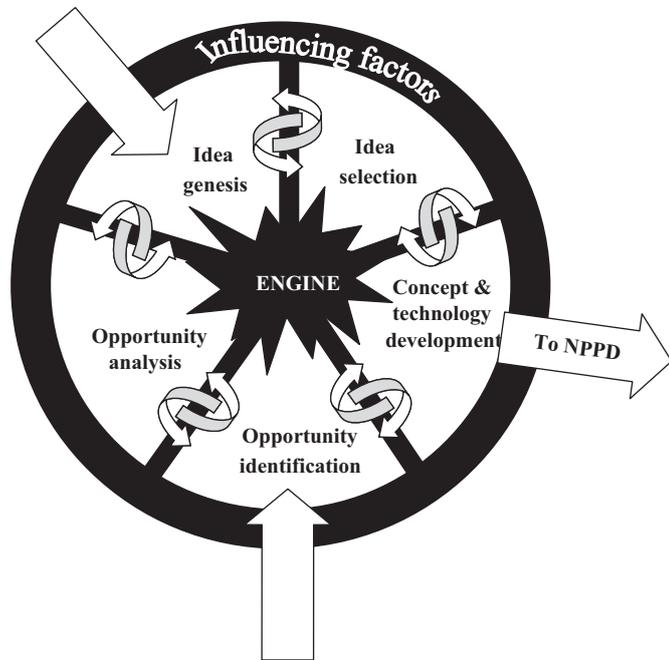


Fig. 4. New concept development model (Koen et al., 2001).

thus, opportunity identification and analysis precede a (business) idea because these stages include an ongoing process of several information enrichment stages, such as market studies or scientific experiments. Finally, a formal business plan or project proposal indicates the changeover to the new product and process development.

A proposal for a more process-oriented procedure is given by Boeddrich (2004) (see Fig. 5).

In this framework, there is a specific differentiation between single process steps on one hand and organizational responsibilities on the other hand. Boeddrich identified company-specific preconditions for the successful management of front end activities, which were confirmed by several other studies (Boeddrich, 2004):

- definition of company-specific idea categories,
- commitment to company-specific evaluation methods and selection criteria, especially with regard to K.O. criteria for approved projects,
- commitment to the owner of the idea management process,
- commitment to individuals or organizational units that promote innovation within the company,
- definition of creative scopes for the company,
- influence of the top management,
- number of stages and gates in the tailor-made idea management and
- investigation of stakeholders in the structured front end and establishment of their participation.

In a recent approach, Sandmeier et al. (2004) defined a very comprehensive process model and went explicitly into the topic of market pull vs. technology push (see Fig. 6).

Phase 1 focuses on the market and technology opportunities of a company. The central and iterative activities are the strategies and goals of an innovation. Finally, there are one to two opportunities and search fields for the next stage. The following phase deals with the actual idea generation and evaluation, including several sub-processes

Strategic guidelines for innovations	Idea generation and adoption	Idea screening execution and further conceptual development	Preliminary projects	D E C I S I O N	Portfolio of innovation projects
Idea management, concept finding phase, predevelopment phase					Project management
Development of innovation-guidelines by top management and innovation manager	Strategic analysis of ideas by idea or innovation manager	Cross-functional teams reach decisions on ideas based on estimation (product, technical, financial, and market attractiveness)	Verification of estimations		Multi-project-management Allocation of R&D-budget

Fig. 5. Front end model proposal (Boeddrich, 2004).

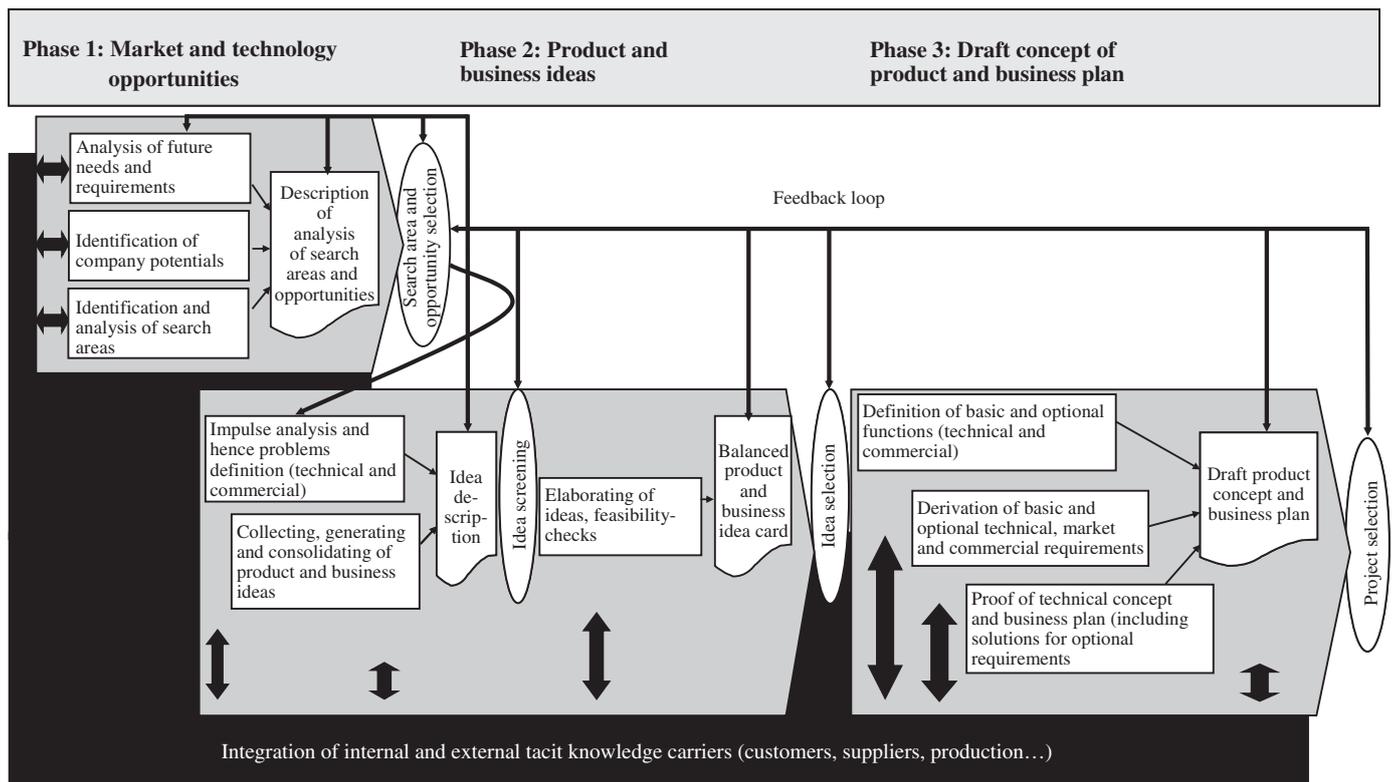


Fig. 6. Integrated front end process model (Sandmeier et al., 2004).

in order to result in the creation of balanced business and product cards. The final phase transfers the generated ideas into business plans and product concepts, which will be devolved to the product development phase. Moreover, role-specific responsibilities are assigned, depending on the innovation development progress.

It can be deduced that the described models vary in terms of perception, resource considerations, and detailing. What they have in common is that they are all based on case studies and not on quantitative research. Hence, even across a range of different companies, industries, and strategies of product and process development, the front end innovation challenges and threats seem to be very similar. There continues a need for additional inter-branch-based research for further consideration.

Considering the above background, this paper makes a synthesis of recent literature and evaluates the synthesis in light of what is learned through the case study to see whether sector and/or branch specific-approaches are needed.

2.1.2. Market pull vs. technology push

Generally, there are two common ways innovation impulses differ (Boehme, 1986; Brockhoff, 1969; Bullinger, 1994; Schoen, 1967):

(i) *Market pull/demand pull/need pull*: The innovations' source is a currently inadequate satisfaction of customer needs, which results in new demands for problem-solving ('invent-to-order' a product for a certain need). The impulse

comes from individuals or groups who (are willing to) articulate their subjective demands.

(ii) *Technology push*: The stimulus for new products and processes comes from (internal or external) research; the goal is to make commercial use of new know-how. The impulse is caused by the application push of a technical capability. Therefore, it does not matter if a certain demand already exists or not. In this context, Gerpott (2005) makes a difference between high and low 'newness' of the innovation and thus between radical innovations ('technology push') and incremental innovations ('market pull') (see Table 2).

Therefore, technology push can be characterized as creative/destructive, with new/major improvements; market pull, however, is a replacement or substitute (Walsh et al., 2002). Another view comes from Abernathy and Utterback (1978), stating that radical product and process innovation is subsequently followed by incremental innovations. This is in accordance with Pavitt (1984) who states that technology is particularly relevant for the early stages of the product life cycle, and market factors especially for their further diffusion.

A sole focus on technology push can lead to the so-called 'lab in the woods approach', where the R&D department is organizationally and regionally undocked from the rest of the corporation, working without any daily routine on technological developments. This approach often results in 'reinventions of the wheel' and, consequently, ineffective research. A strong concentration on market pull tends to

Table 2
Differentiation between technology push and market pull (Gerpott, 2005)

Description/attribute	Technology push	Market pull
Technological uncertainty	High	Low
R&D expenses	High	Low
R&D duration	Long	Short
Sales market-related uncertainty	High	Low
Time-to-market	Uncertain/ unknown	Certain/known
R&D customer integration	Difficult	Easy
Kinds of market research	Qualitative- discovering	Quantitative- verifying
Need for change of customer behavior	Extensive	Minimal

Table 3
Summary of deficiencies and shortcomings of technology push and market pull (Burgelman and Sayles, 2004)

Technology push	Market pull
Risk of starting with what can be researched and evaluated easily	Risk of looking only at needs that are easily identified but with minor potential
Risk of addressing the needs of the atypical user	Continuing to change the definition of the 'opportunity'; 'miss the opportunity'
Potential for getting locked into one technical solution	Lack of being a 'champion' or 'true believer'

be a 'face-lifting' of current products and services so that there is a high probability of competitive threats based on new or improved technologies (Bleicher, 1995). Another problem is the potential misinterpretation of the market or administrative problems as requirements of new technological solutions (McLoughlin and Harris, 1997).

At the strategy formulation level, the deficiencies and shortcomings become even clearer (see Table 3).

Despite the different approaches, the distinction between technology-induced and market-induced is not always well-defined. Adoption depends on the diffusion trigger as well, because it can be induced by the vendor through aggressive marketing and sales activities, or be motivated by problems or deficiencies in the organizational search for solutions (Pennings, 1987).

The chemical industry of the last century is a good example for market changes without influencing certain technologies or market needs. Until the early 1970s, innovations had been only technology-driven. After the oil crisis, the situation changed immediately: customer and market orientation prevailed, and 62% of new products were market-induced. The next change was in the late 1980s, triggered neither by technology or markets: environment protection laws forced companies to develop new technologies for products not needed until then, such as chemical filters (Quadbeck-Seeger and Bertleff, 1995). Obviously, not all developments can be explained monocausally through specific market demands or new

technologies. However, it can be stated that companies which became market leaders with a certain advanced technology 'tended to loose' their dominant market position by missing the changeover to new technologies (Pfeiffer et al., 1997). Still, distinctions can be made by periods in which either demand or technology played the most important role in corporate innovation management (Ende and Dolfmsma, 2005). Moreover, there is certain proof that other key factors influence product innovation adoption as well: for instance, the entrepreneurial attributes of pro-activeness and risk-taking (Salavou and Lioukas, 2003).

Thus, it is not surprising that there have not been any convincing theories of models and mechanisms for technology origins yet (Geschka, 1995). Demand side factors and technology side factors jointly determine a company's research success (Lee, 2003), and they have to be permanently adjusted to each other (Freeman, 1982). Therefore, successful products and services rely on the targeted combination of market pull and technology push activities (Hauschildt, 2004), since the integration of push-pull factors generally contributes to more innovativeness of the company (Munro and Noori, 1988). In order to achieve this, for instance, networking competence is identified as a fundamental success factor (Gemünden and Ritter, 2001).

An example of successful implementation is the creation and use of multi-company collaborative networks, in which knowledge can be transferred and members of the network continuously attempt to innovate (Chesbrough, 2003). Collaborations with downstream firms and universities are particularly improving the chances of success (Lee and Park, 2006).

2.2. Conceptual linkage

As already shown, there are strong interdependencies between technology push and market pull models; no simple black and white determinations enable or disable a certain approach. However, particularly at the corporate policy level, sustainable strategic procedures are required to efficiently manage the product and process innovation development. Therefore, a simplifying 'overall approach' is inadequate; a pragmatic model is needed. For this reason, a conceptual framework for further considerations will be introduced.

In the relevant literature, there is a common feeling that uncertainty is a crucial factor of management through discontinuous chapters in technological progress and ongoing new technology paradigms (Dosi, 1982; Tushman and Anderson, 1986). In this context, a recently studied case at Volvo Cars clearly showed the need for uncertainty reduction without prematurely closing the scope of innovation (Börjesson et al., 2006). Therefore, Pearson (1990) proposes an innovation strategy dependant on various kinds of uncertainty. He distinguishes uncertainty regarding the technical approach ('means'), the market focus ('ends'), and the timing ('urgency'). So, depending on

Uncertainty regarding			Issues raised and implications for strategy
Means	Ends	Urgency	
Low	Low	Low	Fairly straight forward – maintaining motivation and providing resource is important.
Low	High	Low	Requires systematic market analysis – use idea generation techniques, enter markets sequentially.
Low	High	High	Prioritize and enter rapidly – use joint ventures and acquisitions, do not spread resources too widely.
Low	Low	High	Generate commitment – rugby team approach, give high priority and provide necessary resources.
High	Low	Low	Planned and sequential testing – use alternative approaches, consider doing more background research.
High	Low	High	Set up competitive projects – parallel technical activities, buy in technical skills, know when to stop, but don't give up too soon.
High	High	Low	Background, exploratory research – encourage 'free' activity and 'bootlegging', be open to opportunities.
High	High	High	Multiple approaches – spend heavily on basic and exploratory research, try not to get caught in this area.

Fig. 7. Different kinds of uncertainty and their consequences on strategy (Pearson, 1990).

the level of means, ends, and urgency, other kinds of strategic choices are appropriate (see Fig. 7).

Burgelman and Sayles (2004) suggest three fundamental elements for an enduring linkage between technology push and market pull in order to define viable new business opportunities:

(i) *Technology sources*: Research only works if the researcher's personal interests are being adequately considered, combined with existing corporate expertise, and supplemented with continuing the overview of new technological developments. 'Bootleg research' is a way of pursuing an idea against all organizational odds, but if there is no applicable workflow processing afterwards, this kind of research should be avoided.

(ii) *Market demand*: Marketers must do a permanent search, especially in all areas of customer dissatisfaction. Moreover, ongoing evaluations regarding future potential of new need satisfaction are crucial.

(iii) *Relevant problem*: Relevant problems are initial impulses from internal or external sources for innovation, such as ideas and trends. Other sources or origins of relevant issues are problems of the operating divisions, as well as new opportunities created by external events.

Consequently, the managerial initiatives can be defined in three alternative patterns:

(i) *Technology-competence-driven*: Scientists look for new technologies and scientific breakthroughs with accordant commercialization potential.

(ii) *Market-need-driven*: Marketing-oriented managers steer researchers by referring to exciting and interesting markets with foreseeable high demand.

(iii) *Corporate-interest-driven*: Defined and professed 'interests' of the top management are obligatory. Interests are more than just strategic issues; they involve operational subjects as well.

This is not as self-evident as it seems, because management often postulates goals and expectations which, afterwards, they do not support on their own. So, no matter who seeks to be the proponent of a new idea, ultimately, it must be encouraged by the upper management, even if senior executives are not directly involved in the innovation processes, but rather work behind the scenes to 'pull the strings' (Smith, 2007). In particular, new venture projects often fall out of the 'normal' corporate strategy, so no matter where the innovative impulse comes from, it must be accepted by the upper management. Hence, there is an ongoing need for integrating overall strategic and operative goals and roadmaps within the innovation management.

The corporate-interest-driven part is the most difficult one to implement because, in this case, innovation means the continuous consideration of the company's strategic and operational goals, with successful aggregation between the demand and potential sphere through precise internal communication (see Fig. 8).

Internal communication is a critical point, insofar as the timing of information is a crucial element of the cooperation between technology and market. Therefore, typical risks to detect innovations are based on questions regarding the right information: what information?, when?, how processed?, from whom?, what time horizon?, and so on; to foster communication between the two parties, a functional abstract procedure is necessary.

On this note, either a technological potential 'searches' for different needs or problems to be solved, or a specific need or problem 'searches' for diverse technological potentials (Pfeiffer et al., 1997).

Nevertheless, 'innovation requires collective action or efforts to create shared understandings from disparate perspectives' (Dougherty, 1992, p. 195). Moreover,

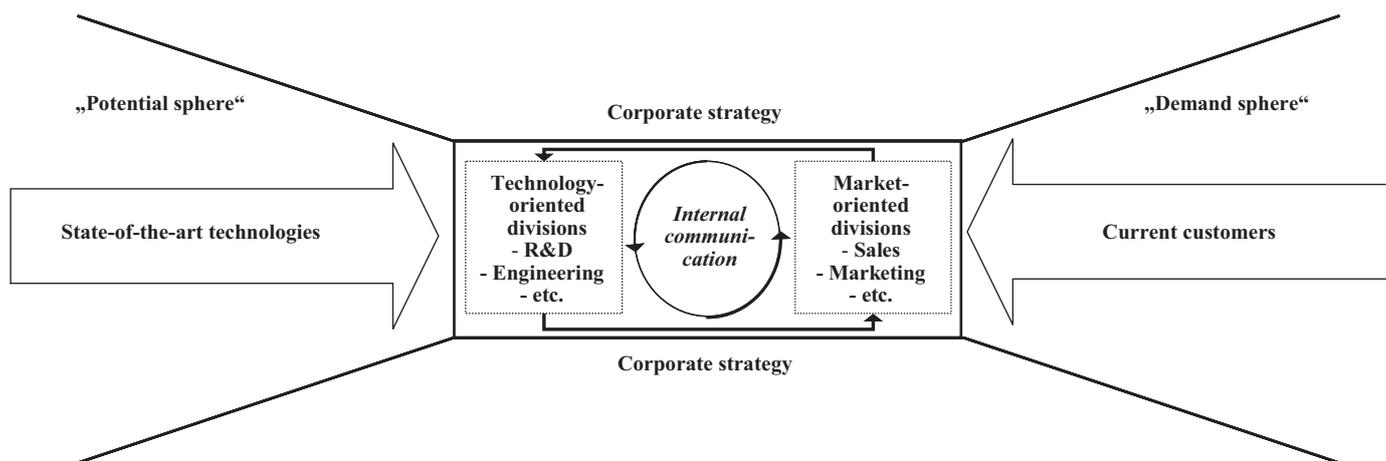


Fig. 8. Coherence between technology and market sphere (Pfeiffer et al., 1997).

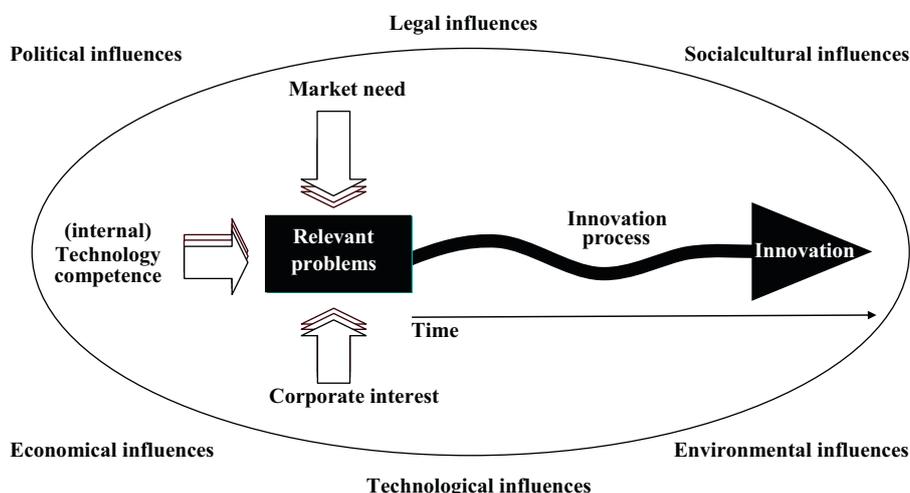


Fig. 9. Triggers and key elements of corporate innovation management.

innovation also depends on factors such as business logic and environmental dynamics. If there is market turbulence combined with market-based business logic, customer and technology linking seems to be a discriminator between low and high innovation. Innovation under technology turbulence depends on the kind of business logic used: market-based logic requires the commitment of the employees for success, whereas technology-based business logic requires broad technology searching (Tuominen et al., 2004).

However, the transition process from technology to market orientation and vice versa requires a change in mindset on the part of the innovators (Ulijn et al., 2001). Still, there are examples of succeeding companies (like Matsushita) which sustainably combine market-oriented product development capabilities with difficult-to-imitate technological capabilities for a highly competitive market position (Kodama, 2007).

Finally, the preceding advisements are summarized in Fig. 9.

Following Burgelman and Sayles (2004), in this context, one can conclude that initial impulses for innovation

(‘relevant problems’) are triggered by corporate interest, technology-competence, and certain market needs. Timing issues affect all kinds of innovation strategies, no matter whether the companies are technology-driven (e.g., in the case of patent expiration) or market-driven (e.g., a product line at the end of the certain life cycle). Hence, time urgency is added as a basic variable as well. The (mostly non-linear) innovation process begins with idea generation, out of the relevant problem, and ends with successful implementation, according to Thom (1980). As the internal corporate innovation process is surrounded and influenced by external factors, which are crucial for the company’s innovations (Brem, 2008; Lind, 2002), they are implicated as well (Fahey and Narayanan, 1986):

- (i) political influences (government stability, taxation policy, social welfare, etc.),
- (ii) socialcultural influences (income distribution, consumerism, education, etc.),
- (iii) environmental influences (protection laws, waste disposal, location, etc.),

- (iv) economical influences (inflation, income, business cycles, etc.),
- (v) technological influences (government spending on research, speed of technology transfer, rates of obsolescence, etc.) and
- (vi) legal influences (employment law, product safety, business legislation, etc.).

This conceptual framework shows the most relevant factors, but still needs to be validated and developed further, especially in order to show how the single elements influence the innovation process and success in detail, as well as the kind of interferences between the elements themselves.

3. Case study: a large German company

3.1. Methodology

The following case study is based on extensive analysis and evaluation of secondary data (corporate documentation analysis) and interviews with managers of different departments (R&D, Marketing, Sales, Technology, etc.) (Yin, 1981). Ten qualitative, guided expert interviews were conducted (Witzel, 2000). These interviews lasted between 70 and 90 min individually and over 13 h collectively, not including time spent on transliteration. Meetings between managers and researchers on a regular basis were organized to validate the findings and to recognize further issues for analysis. Moreover, corporate documentation analysis was done to validate the information gathered. For this, the company supplied internal meeting records, process instructions, and strategy papers.

A single case study was selected because the researched company can be seen as ‘an extreme or unique case’ (Yin, 1994). The company was chosen because of its special market position and dependence on legislation, as well as its unique organizational combination of technology and market, especially with the high regulation influence by the government. The aim of the research was to get deeper insights into their innovation management and hence, implications for the stated conceptual framework (Eisenhardt, 1989).

‘Interviews are a highly efficient way to gather rich, empirical data, especially when the phenomenon of interest is highly episodic and infrequent’ (Eisenhardt and Graebner, 2007, p. 28). All interviews were semi-structured and designed appropriately to the research question. Further input was generated through regular expert meetings with other companies as well. The language of the questionnaire and the interviews was German.

Identifying actors in organizations is critical and sometimes methodically difficult due to the rapid change of corporate knowledge, especially through structural shifts of the responsible individuals (Carlsson et al., 2002). Therefore, the company management was involved to identify appropriate interview partners. Following the ‘snowball

method’ (Carlsson et al., 2002), more interview partners could be found to make sure that there was no pre-selection bias. Moreover, the participants were from different hierarchical levels, functional areas, and company locations (Eisenhardt and Graebner, 2007).

Generally, our interview guideline consisted of two general parts. In the first one, socio-demographic questions were included (e.g., information about the interviewed person such as degrees, job description, prior positions, etc.). The second section is about the specific innovation management in the company, divided into a personal and a corporate level. On the personal level, the interviewees were asked about their definition of innovation, about their own innovative activities, etc. On the corporate level, they were questioned about the way they see idea and innovation management accomplished in the company (e.g., ‘How are new products generated in your company? Which ways are they going? Do you have examples?’ or ‘Which incentives do you have and do you wish to have for fostering idea generation and implementation?’). The interview guideline, in its entirety, can be provided upon request.

3.2. Researched case

3.2.1. Background

Persistent innovation and fast change are the best attributes of the software industry, and not just because of its dependence on the computer industry. To retain the status quo (regarding systems, computers, components, etc.), continuous endeavors are compulsory (Rubenstein, 1989). Therefore, a software development and information technology service provider needs to be up-to-date on all counts. On one hand, it has to offer software and services that enable the customer to make use of the technological status quo. On the other hand, it has to integrate functionality and support which is the only outcome of the customer’s needs, independent of the current state-of-the-art technology. That is why innovation management causes many difficulties, especially in service environments (McDermott et al., 2001).

3.2.2. General company information

The researched company was founded in Germany in the 1960s. Customers are tax accountants, attorneys, public accountants, and chartered accountants, as well as their associated companies. Still, these customers can sell the products and services to their end-customer as well.

The product portfolio includes software (e.g., for accounting, audit, personnel management, etc.), services (e.g., IT-support, print and dispatch-service, etc.) and consulting (on education, training, management consulting, etc.), offered all over Europe. In 2005, the company employed more than 5.390 people, with annual sales of approximately 581 million Euros. The current market share in Germany is approximately 60–80%.

The company is technology-driven, mainly because of its origin in programming and coding-specific software

solutions, as well as offering the corresponding service solutions. Owing to its permanent growth for almost 40 years, organizational structures have not always kept up with the changing business and management requirements. Still, in the last years, the awareness has grown to make changes within the formal internal organization. The perception of innovation management has also changed to a more market-oriented one, in no small part because of ongoing and increasing customer expectations and rapidly changing market conditions.

3.3. Findings: case-specific characteristics

3.3.1. Corporate innovation management

In general, the company differs between a ‘trend’ and an ‘idea’: A trend identifies ‘something new’ and distinguishes it from ‘something existing;’ an idea is a proposal for an action, which either reacts to recent developments or proactively utilizes them. Based on those assumptions, the management has defined a corporate innovation management process (see Fig. 10).

The main steps from idea generation to idea implementation are comparable to the stages shown by Thom (1980). The size of the company requires a division into decentralized and centralized activities. The awareness of different needs in particular phases can be seen in the intuition and logic spotlight at the beginning, as well as in the efficiency and output orientation at the end of the process. The management control board consists of top management representatives from all different divisions. A main focus lies on the permanent controlling of the whole innovation process by means of operating and financial figures.

3.3.2. Former status of technology and marketing

The basic approach is to bring technology and market-oriented knowledge together. The company already has existing departments which deal with these issues. The department of strategic technology monitoring has been

positioned as a competence center, focusing on recent developments in all adequate and interesting technology fields for almost 30 years.

On one hand, this department is supposed to look for technological improvements for existing products and services; on the other hand, it is expected that the staff will discover technologies for potential new products. There are certain responsibilities the employees possess collectively (e.g., for particular products or product groups), but in general, they are free to spend their time on their individual area of responsibility. For instance, they can participate in fairs, exhibitions and thematically fitting conferences, or read newspapers and journals. Team events and meetings also take place on a regular basis to ensure inter-department knowledge exchange. Before that, departments did not directly interact with each other, unless one person addressed another. However, the exchange with other departments of the company had not been introduced yet.

The main task of the strategic product management department is to take care of the corporate product portfolios in a centrally organized way. The general coordination of marketing and sales activities illustrates another duty: supporting the specific product managers in the other departments. These employees are supposed to conduct market research for existing products, as well as search for new and promising markets. Inherently, they have a sophisticated understanding of customers and markets. Several instruments present the background for this, e.g. the product service integration, which provides customer feedback and improvements for all existing products and services. However, the exchange with other departments of the company was still poor.

The environment observation is a cross-departmental function, especially between technology and marketing. The target is to gain information about recent developments in various dimensions (e.g., jurisprudence, competitors, the economy, etc.).

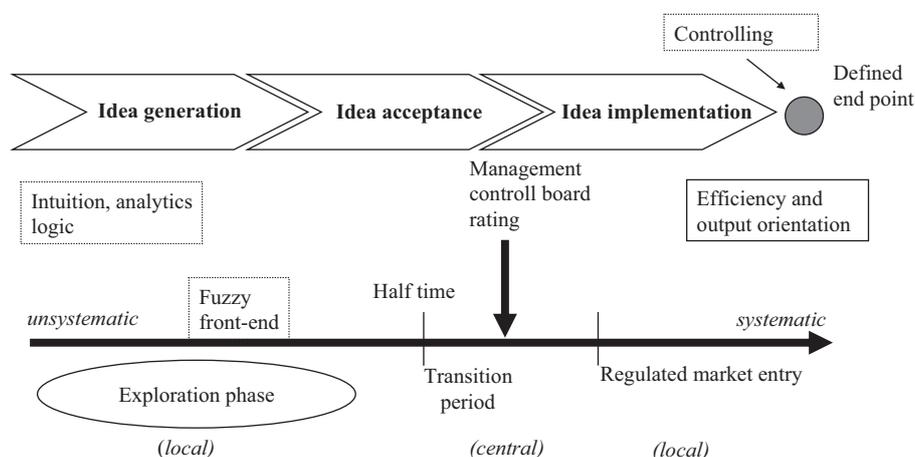


Fig. 10. Overview of the corporate innovation management process, end point, and management control board rating.

3.4. Findings: case-specific integration of market and technology

The unique situation of the company—almost monopolist and strongly dependent on regulations—leads to a phenomenon called ‘regulatory push’. A whole team of environment observationalists continuously screen and evaluate new laws, amendments, and political initiatives on one hand, and on the other hand, continuously estimate and classify future actions, laws, and (political and legislative) changes. If these changes are of only minor importance, required adjustments in current products and services are directly executed (e.g., modifications in current software applications). Impulses for radically new products or services are transferred to the appropriate corporate innovation process (e.g., a new law which allows tax attorneys to found subsidiary companies). This process is initiated by trends and ideas, which are triggered by research, customers, law, etc. (see Fig. 11).

Therefore, ‘idea splitters’ are identified by means of strategic technology and market monitoring. If this is applicable to the company’s innovation search fields, these splitters get a definite structure and design for further enhancements.

Depending on the type and origin of the idea, specific processes are provided. Product improvements, for example, go to the PIMO (Product Improvement Office); product innovations to the PINO (Product Innovation Office), etc. Consequently, people act like project managers in order to drive an idea to an innovation throughout the whole innovation process. The most important success factor in this context is the sustainable integration of the idea contributors. The next steps follow the internal guidelines of efficient project management with adequate milestones, progress planning, and controlling.

In order to gather ‘idea splitters’, employees of the department of strategic technology monitoring, environment monitoring, and product management all practice their described research, monitoring, and management autonomously. Meetings take place on a regular basis to discuss current topics, trends, and opportunities. Then, in coordination with the upper management, stakeholder workshops and scenario groups are conducted.

3.4.1. Stakeholder workshops

So-called ‘stakeholder workshops’ have the objective of bringing internal and external experts together. A special focus lies on the balanced mix of know-how from the fields of technology, market, and regulation (see Fig. 12). Against a background of over 5000 employees and their corresponding departments, it is a challenge not only to bring the internal personnel together, but also to integrate external parties on a regular basis.

Within this concept, a workshop is opened to other external parties, distinguishing between experts and interested parties. Experts can be chosen from ‘friendly’ organizations and companies such as industry associations, law specialists, economy professionals, etc., while interested parties can be either internal (like corporate planning or field service) or external (like suppliers or distributors). Depending on the level of abstraction, trends and ideas can be identified and discussed. In the best case-scenario, company-relevant and therefore, product or process-relevant trends can be identified and retained for further developments. The most important outcome is the determination of specific search fields, derived from the identified trends, which are the precondition for the following constitution of foresight groups. Detailed product and process ideas may also result from these workshops. They are directly forwarded to the corporate innovation management system (see Figs. 1–10).

3.4.2. Scenario groups

In order to transfer results from the stakeholder workshop into the company, further internal efforts are needed. Consequently, it was decided to establish so-called ‘scenario groups,’ which consist of people from strategic technology monitoring, environment observation, and strategic product management. First of all, participants from several departments are chosen, eight people at the most. Additional external expertise is added where needed (e.g. for actual jurisprudence knowledge). It is necessary to hold some meetings in advance in order to structure the meetings that usually take two days. From there, marketing staff, business objectives, 5-year-forecasts, and actual environment observations are called in. The technology monitoring also contributes edited and conditioned technology developments and precise new technologies. The goal is now to generate scenarios for the next five to ten

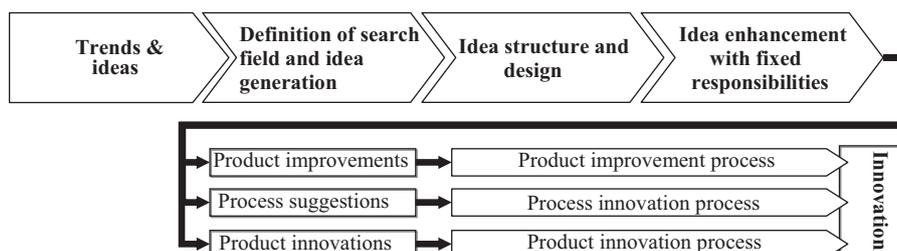


Fig. 11. Overview of the corporate idea management process.

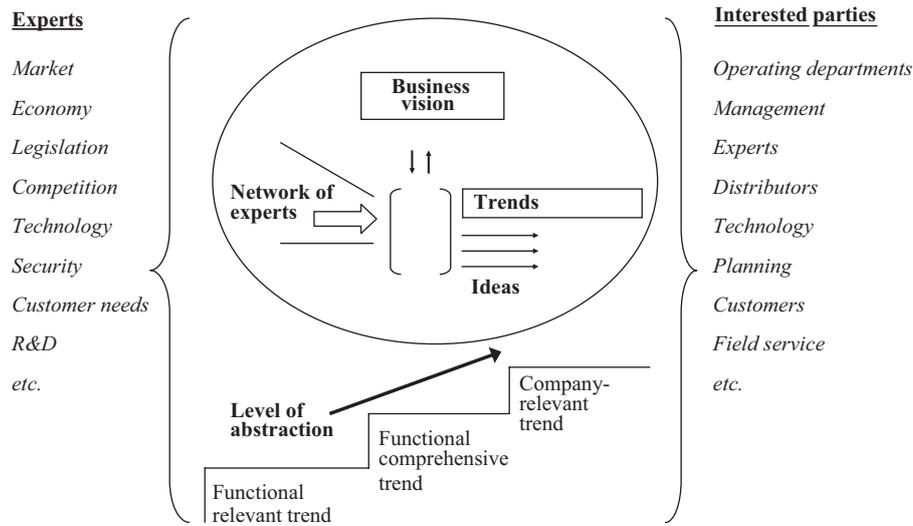


Fig. 12. Concept of a stakeholder workshop.

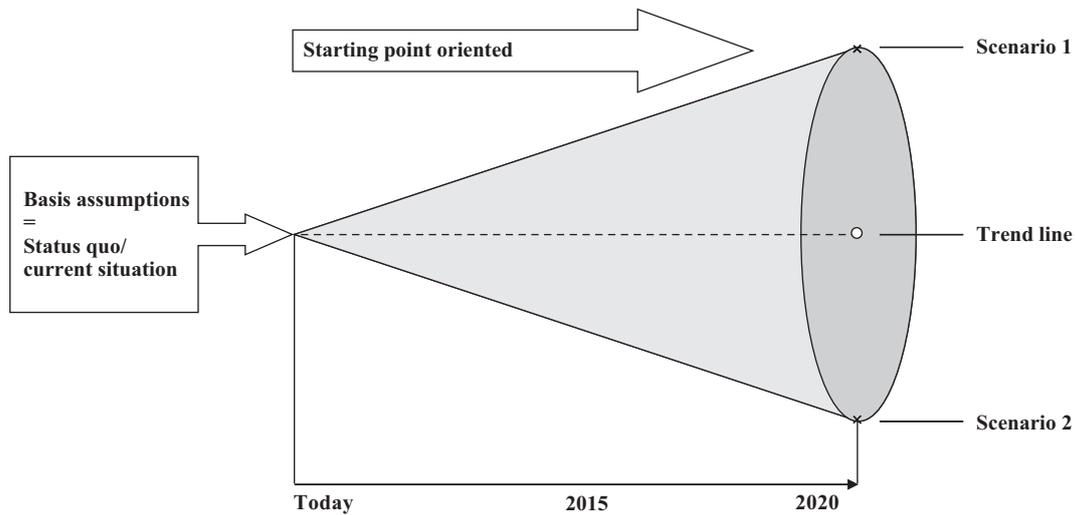


Fig. 13. Explorative scenario planning concept (Gausemeier et al., 1995).

years based on the trends recognized in the stakeholder workshops. So, a target-oriented discussion is possible because all participants have already discussed specific search fields. The people from the technology side report their recently identified technological potentials, while the staff from the market and product side explains new market needs and problems in the context of the existing product portfolio. Employees from environment observation also bring in general trends. Depending on the search field, explorative scenarios or accrued scenarios are applicable. Explorative scenarios evolve into different scenarios based on the current status quo (see Fig. 13).

In contrast, accrued scenarios start from more-or-less defined pictures of the future in order to develop scenarios on how to get there through several stages of development (see Fig. 14).

Thus, dependent on the results of the stakeholder workshop and irrespective of the kind of scenario, either

concept can be the proper instrument for strategic innovation planning. Based on these scenarios, currently offered products and services can be discussed. Furthermore, cases can be developed as to how these scenarios will affect them under different conditions. Finally, ideas for future products and services can be generated.

3.4.3. Further action

The results of the stakeholder workshops and scenario groups are appropriately recorded and transferred into the specific innovation process (e.g., into the product innovation or product improvement process, Fig. 6). All trends and ideas are extensively documented for further presentations and discussions with other employees and partners. However, there are only limited experiences from these introduced instruments, because the first workshop was conducted one year before, and the first results are just getting into action right now.

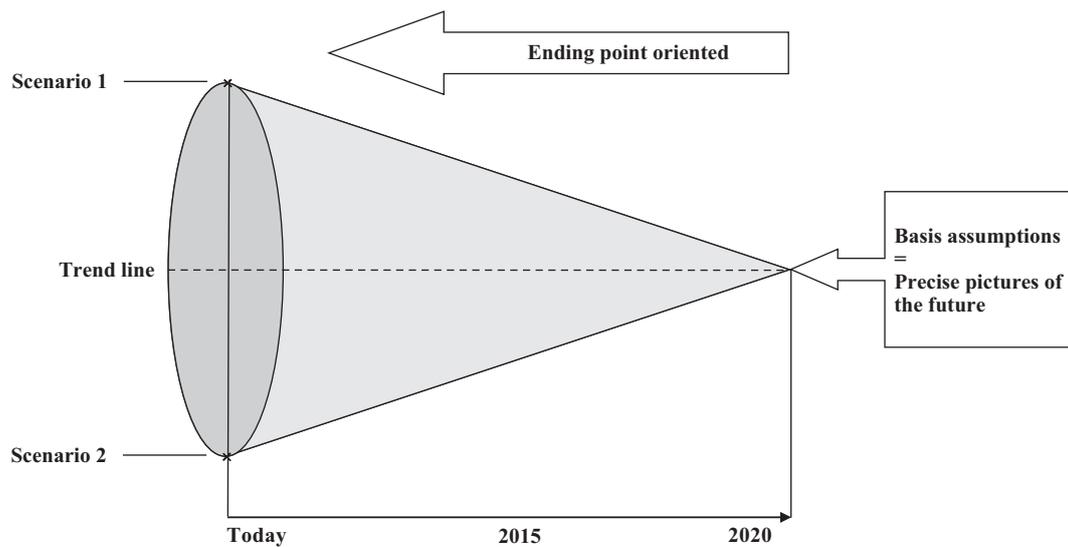


Fig. 14. Accrued scenario planning concept (Gausemeier et al., 1995).

Obviously, the success of this approach depends on the integration of the ‘right’ people experts at the ‘right’ time. For that purpose, applications are possible, but most of the participants are still selected (by the workshop organizer) because they are known as ‘innovative people’. In this respect, a more transparent and traceable process is needed to assure a better integration of the people involved. Moreover, there are no performance measures for the success of the processes yet. As this is a very important part of the innovation controlling, further action is needed in this area to have a better argumentation basis for or against certain initiatives. Currently, the company is thinking about future measures, such as the amount of ideas per team and year, or the percentage of new products (which are less than two years old), in the entire product portfolio.

4. Discussion and implications

As stated, technology push and market pull cannot be declared as the right or the wrong way to sustainable innovations. It depends on assorted variables—such as the specific industry, the company’s history, etc.—which strategy suits best. Some companies are still on the right track by focusing on technology or market needs only. However, there are several examples that a one-sided innovation strategy does not work in the long term either.

Against the background of the case, one can see that bringing technology and market together is not just a matter of (inter-organizational) communication and detailed definition of strategic search fields. All sides of innovation sources are encouraged to give practical input (e.g., the marketing contingent by setting minimum criteria for project evaluations rather than defining general targets) (Becker and Lillemark, 2006). By conducting interdisciplinary teams with lasting integration of internal and external parties, the danger of unidirectional research, as

well as relying solely on market trends, can be reduced. Moreover, the researched company invests many efforts in the idea generation and evaluation phase, which is also very cost-intensive. In this context, recent research indicates that the idea quality and the idea generation phase are important determinants of innovative capacities, especially of large-scale firms (Koc and Ceylan, 2007).

Within the framework of this paper, a new innovation management framework was introduced based on considerations of recent research (e.g., Burgelman and Sayles, 2004; Pearson, 1990; Pfeiffer et al., 1997, etc.). Summarizing the described procedures of the company, a holistic picture of their innovation triggers can be drawn (see Fig. 15).

First of all, there is certain proof that the introduced framework is similar to the processes researched in the case. For example, incremental and radical product and process innovations are induced by market needs (strategic product management staff) and new technologies (strategic technology monitoring department), with relevant problems being supported and controlled by the upper management (corporate interest). In addition to that, the company has well-defined innovation processes depending on the different types of innovations.

Still, there are several points which are not included in the model, such as the intervallic workshops for generating relevant problems. The influence of ‘regulatory push’ is relatively extraordinary as well.

The term ‘regulatory push’ itself comes from the area of ecological economics, and more precisely, from eco-innovations (Renning, 2000).¹ Until now, no technology or innovation management literature could be identified which methodically deals with regulatory push in areas other than ecology. ‘Regulatory push’ can be used to

¹Whereas Renning uses the term ‘regulatory push/pull’ only in context with ecological innovation.

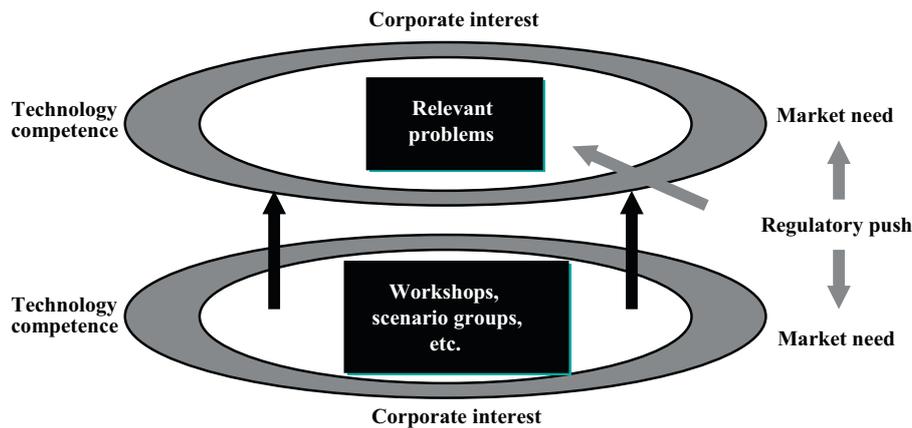


Fig. 15. Case-specific sources for relevant problems.

summarize existing law, expected regulation, standards, political decisions, etc. The origin is not surprising, as ecologically generated innovations are strongly dependent on environmental regulations (for instance, the aforesaid example of the chemical industry in the last century). The regulatory push framework is complemented by other industry, company, economy, and culturally specific features, as these characteristics are leading to different starting conditions in terms of their innovation activities. Moreover, these features can explain the different intensity of the determinants and effects of innovations (Rehfeld et al., 2007). In this case, the regulatory push influences the relevant problems indirectly through market needs (e.g., customers say they need a new tool because of a certain new law), and directly, (e.g., through opportunities for new business models or even business units).

Finally, the question remains as to why previous research did not include a factor like regulatory push. One reason could be the fact that earlier research was done in areas where there were no regulations (e.g., computer industry, desktop applications) or that the regulations were stable and implicit.

The changes introduced in the case are obviously relevant for all companies, but in a special context in this case study, it is because their product and service portfolio is predominantly based on the consequences of legal issues. Therefore, the regulatory push impulses are elementary, affecting the incremental product and service improvements, as well as new product development. In terms of market pull and technology push, these stimuli can be seen as main influencing factors of new or changing market needs. So, the external political and legal influences are playing an especially important role for relevant problems and changing market needs in the future. Furthermore, relevant problems can be directly triggered by technology push, market pull, and/or corporate interest, as well as a combination of all these aspects together via workshops, scenario groups, etc.

Fig. 16 shows the integration of the insights from the case into the adopted framework.

Right now, it cannot be proven that this extended framework is valid for all branches or companies, but it may give some impulses for further research. It is at least applicable for the German software industry, especially in the context of companies in the environment of legal and regulatory issues, as their specific requirements are accordingly integrated. Whether this is a certain German phenomenon or not needs to be researched in future studies. Finally, a generalization of the model depends on the results of future research in this area.

Moreover, there is a great deal of research done in the area of case-specific management systems within the literature focusing on innovation management. Still, there has not been any comprehensive theory developed yet of how to organize corporate innovation on an abstract level, combining the various research results.

Hence, a draft of an advanced idea tunnel as a front end innovation model based on the case study will be introduced (see Fig. 17).

Based on the idea tunnel, several elements were added (e.g., a pool for saving ideas). This is necessary in order not to lose deferred ideas, which are not appropriate to the current corporate strategy guidelines. Moreover, the front end is well-defined as the phase of idea collection and idea creation, enhanced by the level of creativity and the innovation culture of the corporation. Another important aspect concerns rejected ideas. A detailed and comprehensive feedback is crucial in two areas: firstly, regarding the willingness of the involved person for future input, and secondly, concerning the willingness of other people facing the internal and external effects of a disappointed and unsatisfied idea contributor.

Moreover, it is important to guarantee a permanent input of market and technology expertise, and not only within the idea generation stage. Finally, this approach is in contrast to many others not solely aligned to product innovation, but all kinds of innovative ideas. Still, it is fundamental that there is a given process flow for each kind of innovation (Voigt and Brem, 2006).

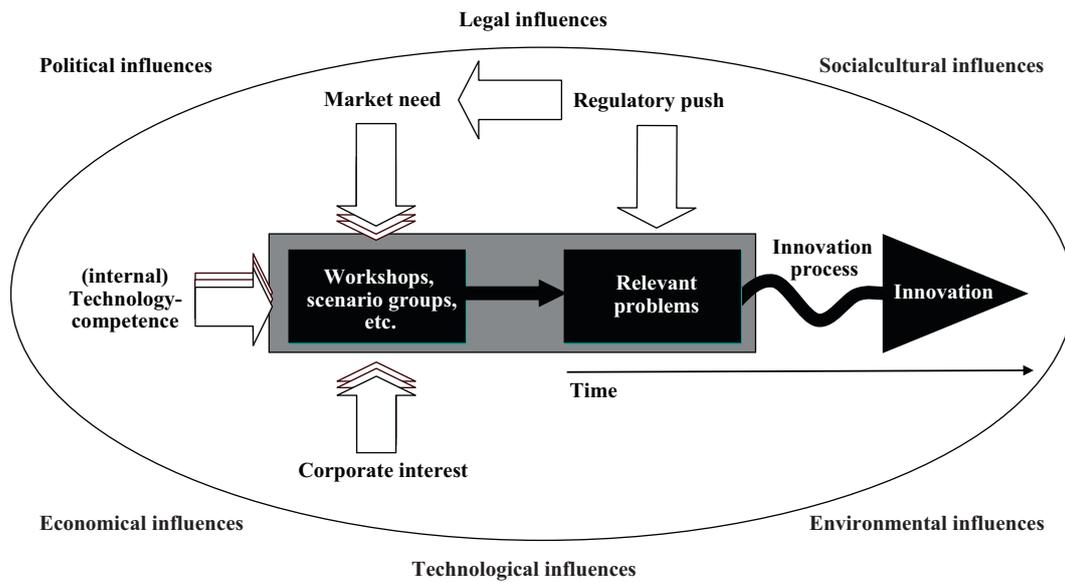


Fig. 16. Extended framework of triggers and key elements for corporate innovation management.

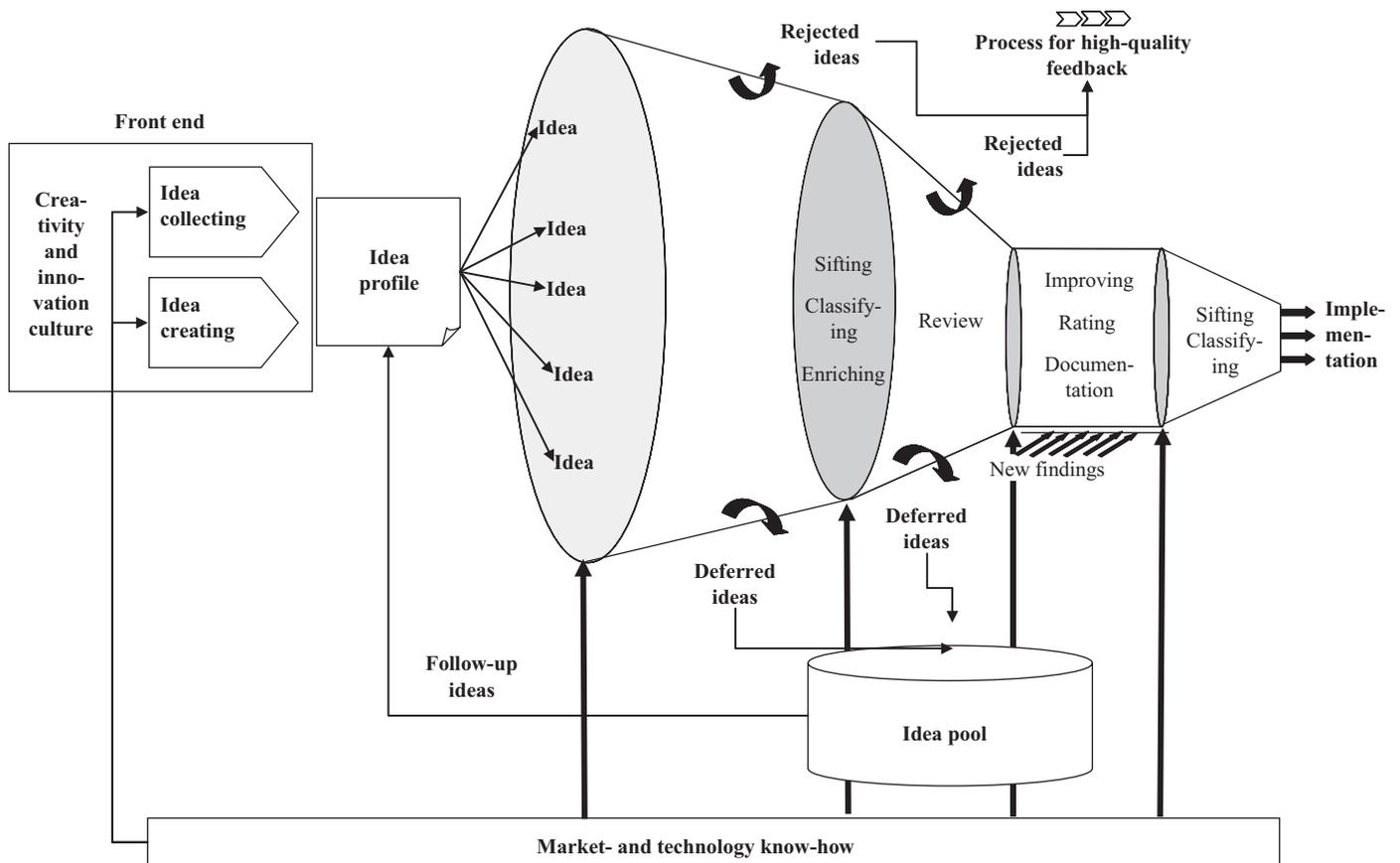


Fig. 17. Advanced front end innovation approach.

5. Limitations and further research

‘Theories and models are always simplifications. If they were as complex as reality, they would not be useful’ (Siggelkow, 2007, p. 21). Therefore, the extended frame-

work must be seen as a discussion basis for further development.

So, even though the considerations for an integrated view of technology and market are already rather sophisticated in this company (compared to other well-known

examples of big firms), it remains to be seen whether this success will last. As the entire approach is still a 'work-in-progress', the solid, scientific proof will be examined at a later point in time. Moreover, results can be dependent on specifics of the software industry. Hence, since the research is based on a single case, conclusions must be seen against this background and can only be drawn within the introduced branch (Siggelkow, 2007). By conducting multiple-case-research, more similarities and therefore, regularities, could be identified for further generalization. Finally, a sampling of extreme cases (e.g., very high and very low performances) could improve the observation and validation of contrasting patterns in the data as well (Eisenhardt and Graebner, 2007).

However, any transition towards a long-term innovation strategy takes at least several years, because of the energy which is necessary even before such a transition can be triggered (Hope Hailey, 2001). Technology managers may use the results as a conceptual mirror, especially regarding the influencing factors of relevant problems (such as corporate interests, technology-competence, market-need, and regulatory push) and the use of interdisciplinary teams with people from inside and outside the company. Still, for companies working in the software industry, this framework can be used as a guideline or benchmark for their idea and innovation management. The advanced front end innovation approach, in particular, shows all critical components of a corporate idea and innovation management which are to be considered.

Future research should focus on the exact integration of regulatory push within the innovation process and within the context of market pull and technology push. On the workshop level, further research is needed to get a deeper insight into the right mix of internal and external experts, as well as the according selection procedures for the 'right' people. Finally, the introduced results are limited to the software industry; therefore further research in other branches and industry is suggested.

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