Structuring the Front End of Innovation

Kurt Gaubinger and Michael Rabl

1 Introduction

Structuring and managing the innovation process represents one of many critical process-related factors traditionally associated with innovation success. One of the principal objectives of process models is to structure typical tasks in the corresponding field to ensure the targeted application of work techniques, methods and tools. A well-defined process is transparent for all departments and a common understanding can be developed, which facilitates communication within the company (Gaubinger 2009). While the benefits of structured stage gate processes are broadly accepted for later stages of the innovation process, at the front end a broad variety of concepts and process models for structuring and systematizing the innovation process currently can be found at the operational level and in literature (Barczak et al. 2009; Cooper 2001).

2 Process Models for Formalization the Front End of Innovation

Managing the Fuzzy Front End is a continuous conflict between creativity and systematization (Verworn and Herstatt 1999). The early stages imply high risk and uncertainty, ill-defined results and an unclear way of setting and achieving goals. Therefore, it is essential for organizing the front end of innovation (FEI) in order to find the right balance between flexibility and creativity (weak-defined processes and targets) on the one hand and structure and bureaucracy (well-defined processes and targets) on the other hand. Too much structure kills creativity, while too little

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structure negatively affects FEI-performance (Gassmann et al. 2006). This relationship between degree of formality and performance shows an inverted u-shape curve implying that too much as well as too little formality is negative. One of the main causes can be found in the turbulent environments characterized by increasingly dynamic and complex markets, rapid technological progress and shortened product life cycles which calls for adaptable and flexible processes (Calantone et al. 2003). Herstatt and Verworn (2007) also stress the importance of a situation-appropriate balance between structured processes and sufficient room for creativity.

There are a vast number of innovation process models which divide the front end into phases, stages, steps or elements, varying with regard to priorities, number of phases, perspective, definition of starting point and the ending point of the process and degree of detail (Verworn and Herstatt 1999). Sequential models follow a linear course, conduct one task after another and thus allow for an easy access of recommended actions, facilitating transparency and predictability (Khurana and Rosenthal 1998). However, they also run the risk of not corresponding to reality and of not adequately considering creative exchange and feedback loops among employees. To speed up innovation pace scholars suggest parallelizing development activities. As Cooper (2011) states, more activities are undertaken in an elapsed time by multi-disciplinary teams with parallel processing (rather than sequential). Generally, parallelism and integration of external stakeholders seems to be a central success factor not only in the NPD execution but also in the FEI.

In sight of turbulent environments some researchers advocate flexible processes in innovation management additional to parallelism. Models with flexible and dynamic processes, feedback loops and parallel actions are mainly referred to iterative process models in the literature (Sandmeier and Jamali 2007). Koen et al. (2001) for example support a circular shape of the front-end elements, which means that ideas are expected to flow and iterate between the sub-phases, because these sub-phases of the fuzzy front end are unpredictable, chaotic, informal and poorly-structured by nature. According to Ayers et al. (1997), flexibility, ambiguity and keeping a broad set of possible options open are especially vital to innovation success. Cooper und Kleinschmidt (2007) also point out that top companies conduct their innovation processes in a flexible and scalable way.

Never the less the actual implementation of flexible models in a company turns out to be difficult due to the abstract nature of these models not lending itself easily to deriving concrete recommended actions for employees. However, the developments in information and communication technology have the potential to enable the implementation in an efficient manner. Furthermore the use of linked IT-systems, simulation and rapid *prototyping* technologies, and comprehensive information systems continues to reduce development time and development costs. ‘Electronification’ of innovation processes thereby constitutes a decisive feature of the latest generation of innovation management processes.

2.1 Variable Degree of Structuring the Front End of Innovation

The term 'fuzzy front end' incorrectly suggests that the early stages of the innovation process have to be unstructured, fuzzy and chaotic by nature and cannot be managed because of all its unknowable und uncontrollable factors (Koen et al. 2001). However, creative problem solving needs not necessarily occur chaotically, but may very well be subject to certain structures and regularities. This rather speaks for the position of Steiner (2003), which holds that a deterministic chaos, where creativity is guided through certain formal processes, is advantageous as it enables employees to fully unfold their creative potential in the various steps without distraction and with clear goals and time-frames. Quinn (1985) also perceives 'controlling the chaos' as a potential way out of this dilemma. This approach does not imply suppressing the chaos, but just controlling it. Similarly, Brown and Eisenhardt (1998) point out the importance of a 'dissipative equilibrium' between chaos and bureaucracy. For Van Aken and Weggeman (2000), an ideal management regime contains approaches that both operate formal (tightly managed) and free (undirected exploration). Cooper (1994), for example, provides with his stage-gate-process with flexible gates and fluid stages (third generation) an approach, which manages well the straddle between chaos and bureaucracy. Hence, due to the pros and cons of both sequential and iterative models, many researchers look for a combination of these two approaches in order to find a process structure (Sandmeier et al. 2004).

Effectively managing the fuzzy front end of innovation represents one of the most important and simultaneously challenging activities for innovation managers (Kim and Wilemon 2002). In the later phases of the NPD process a structured stage gate process is widely accepted in theory and practice, whereas difficulties arise from the fact that the early innovation phase is mainly considered as dynamic, fuzzy, unstructured and hardly formalized (Murphy and Kumar 1997). Process models have been developed to structure the front end of innovation to reduce its uncertainty (Holtorf 2011) and to visualize and manage the process in its entirety (Rothwell 1994). Consequently, the following chapter is concerned with the evolution of process models for the front end of innovation.

Selected from the multitude of available models, the ones presented in the following section are the models that are frequently quoted in literature.

2.2 Stage-Gate Process (Cooper)

The Stage-Gate process divides the innovation process into stages separated by gates where go/no-go decisions are made based on information generated during the activities in the previous stages (Fig. 3). The new ideas collected during the discovery phase (stage 0) through internal and external sources are evaluated and filtered during stage 1 according to criteria like strategic fit, market attractiveness and technical feasibility. During the scoping phase (stage 1), a first rough elaboration of market-related and technical advantages is carried out, to be followed by

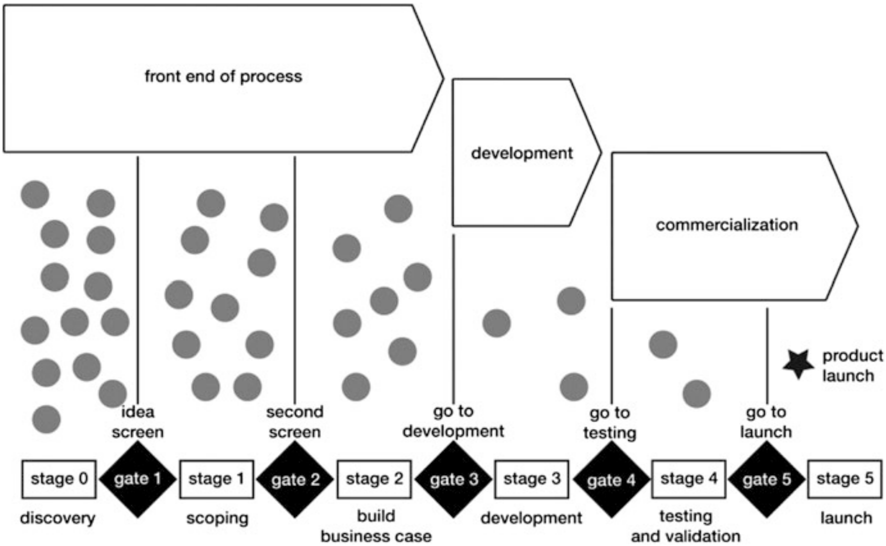

Fig. 3 Stage-gate process (second generation)

further evaluation at gate 2. At the subsequent stage 2, detailed tests with regards to technology, market and competition are carried out, culminating in the draft of a business case depicting the route from ideas to product concept. At gate 3, which separates the front end of innovation from the development phase and is also referred to as 'money gate' since the firm has to decide if it is willing to allocate resources; an even more detailed assessment forms the basis for making a decision on the launch of a development project (Globocnik 2011).

Cooper's model has evolved over time through several generations and is one of the most frequently cited models. He expanded the above described so-called second generation model into the stage-gate-model of the third generation, characterized by 'four fundamental Fs' (Cooper 1994). Transitions between stages are fluid and activities can be conducted increasingly in parallel fashion (*fluidity*). Within the scope of a gate-decision, a project can be continued to some degree even if not all criteria for the respective stage have been met. Cooper talks about 'fuzzy gates' here. Likewise, tasks of a subsequent stage can also be carried out prior to a gate-decision. An optimal allocation of resources between different innovation projects is an increasingly important factor in determining gate decisions (*focused*). Also, in third generation stage gate models, projects only have to pass through certain process stages, depending on the respective project's degree of risk (*flexibility*). Processes are perceived as being scalable, hence those with a lower degree of risk can be processed in a 'leaner' way, i.e. in fewer process segments and gates. One of the drawbacks of third generation process models, though, is that flexibility is often achieved at the expense of robustness, with projects that are continued on condition often not being aborted on time. The last 'evolutionary stage' of innovation process management systems is subsumed by Cooper's terms *NexGen*

Systems (Cooper 2008a). In addition to an increased degree of scalability and flexibility, the most characteristic feature of the latter model is its openness in the sense of the open innovation approach.

2.3 Three Phase Front End Model (Khurana and Rosenthal)

Khurana and Rosenthal separate the front end of innovation in their sequential process model into the three sections pre-phase zero, phase zero and phase one. In addition to project-specific elements (such as project definition, respectively -planning, as well as the product concept), which continuously support the project, project-independent activities, so-called *foundation elements*, also influence pre-phase zero. The foundation elements can be considered as important push factors during the early phase and as influencing the quality of implementation as well as the efficiency of individual phases. They primarily comprise a clearly defined product-and portfolio strategy as well as clearly defined roles, norms and structures for the organization of product development. Over the course of pre-phase zero, innovation opportunities are being searched for, ideas are being generated via market and technology analysis and the new innovation project is launched, with an elaboration of the concept to follow in the ensuing phase zero. In phase zero, not only customer needs, but also market segments, competitive situations and business prospects are identified. Finally, in phase one, the technological and economic feasibility of the product concept is assessed and the product development concept is planned. The early phase of an innovation project eventually ends with a decision on the continuation or conclusion of the presented business case, presented as go/no-go decision (Khurana and Rosenthal 1997, 1998) (Fig. 4).

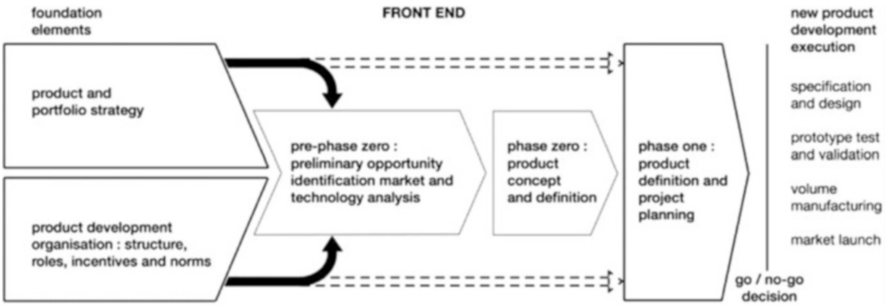

Fig. 4 Three phase front end model

2.4 New Concept Development Model (Koen et al.)

The New Concept Development (NCD) Model from Koen et al. is intended to help people to better manage the early stages of the innovation process and to provide a common language on the front-end activities. It consists of the three parts engine,

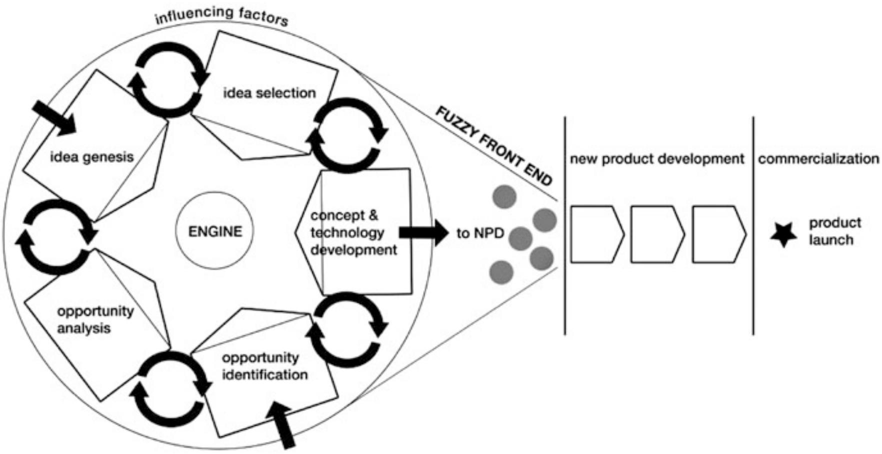

Fig. 5 New concept development model

front-end elements and influencing factors. A characteristic feature of the NCD Model is the circular, iterative arrangement of the five front-end elements. They are not subjected to any particular order, but can be carried out at random, as often as desired, in parallel fashion or consecutively. In the course of opportunity identification, taking into account the goals of the company and resorting to tools and techniques (e.g. brainstorming) as well as problem solving techniques (e.g. causal analysis), potential chances respectively possibilities are being found, until finally at the stage of opportunity analysis, technological and market-related criteria are used to assess the question of whether the pursuit of an opportunity makes sense. In the phase of idea genesis, detailed ideas are developed in an evolutionary, iterative process. The most promising ideas are selected in the following process of idea selection. The engine of the front end elements comprises all factors that can be controlled and steered by the company (e.g. leadership, culture, business strategy) and create an environment for successful innovation. In addition, internal (organizational skills, technologies, strategy) as well as external strategies beyond the company's control (channels of distribution, customers, competitors) also influence the front end of innovation (Fig. 5).

In their NCD model Koen et al. put the focus on the product development aspect and integrate the technology process development only partially – if at all. The larger the investment into a technology development process is, the more resources are needed, the more structured is the way the decisions are made and the less likely is the integration of technology development into the framework of the NCD process (Koen et al. 2001, 2002).

Table 1 summarizes the advantages and disadvantages of the three described models.

Table 1 Pros and cons of front end process models

Model	Pros	Cons
Stage-gate process (Cooper)	Very famous and frequently cited model	Product concepts can be stopped to early
	Flexible to both radical and incremental innovations	Gatekeepers low level of knowledge can lead to wrong decisions
	Integrates both the market and technological perspective	Lack of flexibility due to sequential approach, except third generation model
	Activities are performed in parallel fashion	
Three phase front end model (Khurana and Rosenthal)	Additional consideration of elements of the organizational environment (foundation elements)	No feedback loops
	Useful tool to visualize and structure front-end activities, reduce the fuzziness and ease communication	No description of the preliminary opportunity identification and idea generation in detail
		Tool lacks flexibility
		Decision making could be enhanced by a more structured process (especially in the pre-phase zero and phase one phases)
New concept development model (Koen et al.)	Includes all company related factors	Abstract model that is hardly transferable to a business situation
	Stimulates innovation due to its non-sequential order of phases	Practitioners criticize the lack of application of these methodologies
	Flexible with regards to both radical and incremental innovations	Model mainly focuses on product development
		Influencing factors are not controllable

3 Conceptual Design of a Process-Oriented Framework for Structuring the Front End of Innovation

To balance the aforementioned conflict between structure and creativity respectively flexibility, a new scalable process-oriented framework for structuring the front end of innovation was developed. Figure 6 shows the fundamental structure of this framework and its four modules. The module *innovation strategy* encompasses three stages and is dedicated to strategic oriented opportunity identification. The integration of *technology development* (TD) as a main module of this framework is due to the fact that although TD projects represent a small proportion of a typical company's development activities, they are often vital to the company's growth and survival. Therefore TD projects have to be selected and managed in a systematic and focused manner throughout a well-defined process model (Cooper 2006). Because TD projects are quite different in terms of risk, uncertainty, scope and cost of typical *new product development* (NPD) projects, these processes have to be different from traditional NPD processes. Nevertheless this module is only relevant

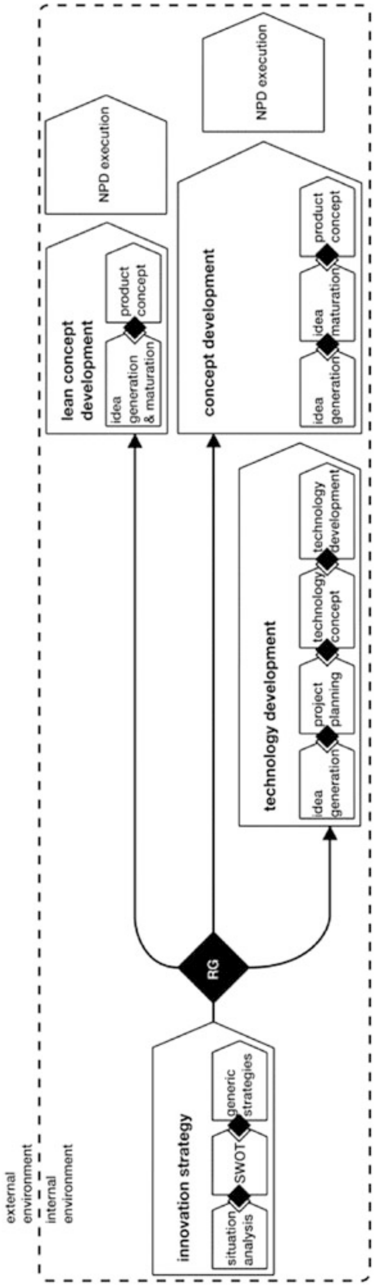

Fig. 6 Holistic framework for the front end of innovation

when the output of the strategy phase aims to develop new technologies and is therefore an optional part of the framework.

Because theory and practice show that one innovation process model does not fit all projects, the developed framework is a scalable model and includes two different front end processes for concept development. In accordance with Cooper (2008b), major new product or platform developments have to go through a finely structured multi-stage front end process whereas moderate-risk development projects such as modifications, re-launches and extensions follow a leaner process with fewer stages and gates. Hence it is essential that the routing decision at *routing gate* (RG) for the type of process depends on the novelty degree and on the risk level of the potential project respectively. *Pöttinger*, a leading Austrian manufacturer of farm machinery, for example has implemented two different process models for predevelopment activities and series development depending on the novelty of the idea.

In detail, at the aforementioned gate RG a 'strategic courses of action related to innovation' which is the outcome of the strategic phase has to be assessed in a two-step procedure. First, it has to be evaluated if the potential project is targeting either towards new correlation effects between the natural sciences and technical advancement or towards the enhancement of an existing product or the development of a new product. In the first case the process technology development must be chosen. If the identified strategic courses of action is related to the improvement of an existing product or the development of an new product the second evaluation stage has to be executed. Ideally, thereby an utility analysis should be applied, which assesses every project regarding estimated development costs, potential payoffs, and the novelty degree regarding technological, environmental, organizational and market aspects.

Generally all activities encompassed by the model should preferably be carried out in a parallel manner at all stages, both within disciplines (e.g. technology, marketing, design) as well as across disciplines. Here parallel means that inside the stages iterating and overlapping activities of the multidisciplinary team members are typical. Moreover, two characteristic features of this model are its openness in the sense of the open innovation approach and its fuzzy gates, where projects can be continued to some degree even if not all criteria for the respective stage have been met.

3.1 Innovation Strategy

Without a clear innovation strategy, decisions at the front end of innovation become ineffective. An innovation strategy expresses a company's long-term innovation goals and primarily comprises all strategic statements on development and marketing of new products, technologies and procedures as well as on the opening of new markets. Innovation strategy is always part of a set of strategies. Its objectives are derived from the overall corporate strategy and it is linked particularly to marketing strategy (Trott 2012). A clearly defined innovation strategy determines where a company wants to focus its R&D efforts and therefore where it wants to search for ideas (Cooper 2011).

The process of formulating an innovation strategy can be set off by various impulses. Relevant literature distinguishes the two prototypes of innovations initiated by newly developed technologies (technology push) and innovations triggered by customer's needs (market pull) (Deppe and Kohn 2002). In the first scenario, innovation activity is mainly competence-driven, while innovations in the second scenario are being developed with the goal of satisfying specific or sometimes latent customer needs. In general, the two prototypes do not occur in pure form. Rather, we can observe multiple factors triggering innovation in parallel fashion. Regardless of the engine of an innovation, the decisive factor for its success consists in acknowledging customer needs and problems by matching offers, thereby generating value for the customer and also, in the final analysis, for the company.

Several steps have to be taken when implementing an innovation strategy. The starting point consists in comprehensive analyses of the company-internal and external situation. These analyses generate information on existing product offers and possible innovation potential, providing a basis for defining and implementing concrete strategies. In order to ensure long-term market success, innovation management has to carry out a situation analysis (Cooper 2011). This assessment focuses on the current and future economic and technological situation of the company and the relevant business environment (internal assessment).

Since development and changes of the business environment considerably impact the success of a company, it is essential to analyze current and future developments outside the company by means of a systematic *external assessment*. This procedure primarily serves the purpose of identifying new *innovation opportunities*. At the same time, it is meant to identify developments that constitute *threats* to the company's success. In order to identify opportunities and risks, one needs to select from all possible variables of the company's micro and macro environment those that are especially relevant to the company's specific decision-making situation.

When defining innovation and new product strategies, it is advisable to conduct a PESTEL analysis focusing also on technological developments, since a technology-oriented early warning system gains in significance as product life cycles become increasingly shorter (Gaubinger 2006). As a matter of fact, it should be noted here that the early identification of chances and risks is of central importance, since the resulting head start constitutes an essential competitive advantage in an increasingly dynamic and discontinuous business environment. However, when aiming for innovation opportunities within the framework of strategic planning, simply focusing on the business environment is not enough. The company also needs to have the necessary competence and potential in order to actually use those chances.

An *internal analysis* serves the purpose of identifying the strengths and weaknesses of a company in relation to its strongest competitors. In many cases this task is organized by evaluating each of the activities of the value chain. In a second step, the company's strongest competitors are assessed in terms of their potential. In a final step, a figure depicts the company's strengths and weaknesses in relation to its competitors in a polarity profile. The profile yields important information with regards to the relative potential for developing product innovations. In the course of the SWOT analysis, identified strengths and weaknesses as well as opportunities and risks are related to each other. In this context, the aim of the SWOT analysis consists in deriving concrete strategic courses of action related to innovation. Once the analysis of the strategic starting position has been completed, the results of the analysis can then constitute the basis for making long-term decisions with regards to innovations.

Thereby the following two generic archetypes of strategies can be used to define the fundamental orientation of the innovation activities:

Product-Market-Focused Strategies. Based on Porter (1980) a company has the option to pursue differentiation strategy, which focus on the development of distinctive offerings delivering superiors value to the target segment. Another option is to focus on cost leadership where a company competes by being able to lower its costs relative to the competitors. This can be achieved through downsizing, experience effects in volume production or organization improvement by leaner processes. The third approach targets a specific need of a market niche where the competition is less intense.

Time-Based Strategies. This set of strategies refers to the aspect, whether a company intends to be a first or early entrant into the market or a late entrant. In following a pioneering strategy, a company pursues the goal of occupying the position of innovation leader in the market, e.g. of being the first one to place new developments on the market. On the negative side of the balance sheet is the fact that it usually falls on the pioneer to build up the market for an innovation and to be the sole carrier of costs for communicating the perks of the innovation (Walker and Mullins 2011).

A second option with regards to market entry consists in pursuing an imitation strategy, i.e. observing the innovation activities of the competitors and imitating promising innovations. Pursuing this strategy, the company can either take on the role of the *fast follower* or that of the *late follower*. The fast follower enters the market shortly after the pioneer with a comparable product, while the late follower postpones market entry until the point when market developments and demands have stabilized. The fundamental chances following from the pursuit of an imitation strategy consist in minimizing risks and costs of market entry in relation to the pioneer, and in utilizing the pioneer's experience for the company's own product optimization. However, the strategy's drawback is the fact that it does not yield pioneering profits, only the status of a productivity or efficiency leader. If customer needs are already being met in a satisfactory way by the pioneer, this market scenario provides significant obstacles for successfully competing against the pioneer (Ahmed and Shepherd 2010).

3.2 Technology Development

Following Cooper (2006), the technology development process ‘feeds the NPD process’ and consists of the following sub phases: idea generation, project planning, technology concept and technology development. Especially in the field of technology development, idea generation is often done by members of the R&D department, but it should be also the result of other activities. As mentioned above, ideas should be proactively generated within the strategic areas, which are defined in the strategic planning phase. Furthermore, the results of the external assessment (technology forecasting, scenario planning, customer analysis) should focus the idea generating activities. Within these search fields a lot of technology ideas should be generated, derived from different internal and external sources of information. A structured suggestion scheme and the integration of lead experts and lead users ensure the appropriate direction of the idea-finding process. Finally, alternative ideas for new technologies are evaluated in interdisciplinary teams, which consider a certain market orientation also within the context of technology development projects.

In the phase of project planning it is necessary, that the whole development team creates a general state of knowledge (Slama et al. 2006). Essential activities in this phase are technical literature search, patent and IP search and a preliminary technical assessment (Cooper 2006). Based on these activities, an initial project plan is prepared. Since TD projects are usually based on a set of vaguely defined market information at project start, project planning must be specified with increasing levels of information in the ongoing phases.

In a next step the technology concept must be defined. Based on a detailed conceptual technological analysis the application potential of the new technology concept has to be evaluated. Since possible areas of applications of technologically induced innovation ideas are often unknown (Herstatt and Lettl 2000), promising areas of application and target segments for the new technology have to be identified (Bower and Christensen 1995). Start of this activity is the determination of the strengths and weaknesses of the new technology (Schwery and Raurich 2004) and the subsequent translation of these features into utility functions. Based on these results a list of potential industries can be narrowed down by means of a stepwise assessment procedure. Thereby industries with potential application fields have to be evaluated concerning their strategic fit and their attractiveness with checklists. With even more detailed analysis relevant target industries and target market segments can be determined. These activities are the foundation for the identification of a pilot customer, who ensures the application-oriented development of the new technology happening in the next phase.

In the technology development phase, the full experimental plan has to be implemented and the technological feasibility must be proved. Effectiveness of development activities can be improved if a potential user of the technology or a potential customer can be already integrated in this phase to evaluate and determine specific technological requirements and basic conditions. The inter-organizational planning and the execution of the project have to be carried out using sound project management tools.

3.3 Concept Development

Following the strategic phase or building on existing technologies, respectively, successful products have to be developed for the search fields identified this way. In the first step, concrete ideas have to be seized upon. According to the solutions' degree of novelty, the process of *ideation* can be divided into *idea gathering* and *idea generating*. The process of gathering ideas resorts to existing ideas from various sources, which can be internal or external. In contrast, the process of generating ideas uses an array of methods, e.g. creativity techniques, for generating new solutions. During the process of compiling and storing ideas, problem-solving strategies are systematically categorized and stored in a standardized form, to be evaluated in the subsequent phase of *idea screening*. In the sub-phase *idea maturation* a quick scoping and a further specification of the project is done. Based on these steps technical feasibility, prospective market success and the contribution for reaching the goal have to be evaluated. The ideas selected in this process constitute the basis for a detailed product conceptualization. Product conceptualization takes its starting point from the results of idea assessment, consisting in relatively abstract problem-solving strategies. Through multiple phases of filtering, ideas are being selected, starting with a *rough selection* characterized by a very low degree of specification and using tools such as oral assessment, checklists, utility analysis etc. This process should use criteria for evaluation that can be informative in a multidimensional way in terms of marketability and technical feasibility.

In an additional step, the product has to be further specified within the framework of *conceptualization*. In this step, all of the gathered information on target markets, target groups, competitive situations and potential for differentiation is condensed and recorded in the *product brief* (Werani and Prem 2009). This document essentially describes the product requirements in detail and usually contains the following items:

- Definition and description of the target market,
- Demands of the customers,
- Essential performance data of the product,
- Relevant external and internal restrictions,
- Estimated production costs and product costs and
- Deadlines and project milestones.

Once the product concept has been finalized, a business plan is drawn up, leading on to the clearance for product development. Thus the starting signal for product realization in the iterative cycles of design, prototype construction and testing has been given (NPD execution).

3.4 Lean Concept Development

For projects of moderate risk, such as modifications and improvements, the lean concept development process is appropriate. In this process, *idea generation* and *idea maturation* are performed on a reduced level without a formalized gate between these two phases. In contrast to the full concept development process shown above, the gatekeepers to the next phase *product concept* are typically not the senior management team, but mid-management (Cooper 2011). As in the previous phase, the activity list in the concept phase of low-risk development projects is reduced and also the specification sheet is more compact.

4 Implementation of Process Models

Due to the cross-functional relevance of the process model described above as well as the strategic importance of the activities encompassed in it, its implementation is a challenging task. Therefore, following the discussion in Cooper (2002), process implantation shall proceed in four steps with regards to the introduction of the stage-gate process.

4.1 Teambuilding

Since the introduction of a comprehensive process model requires the involvement of a large number of people, the designated project coordinator, in cooperation with management, has the responsibility of building a *project team*. This team should be representative of functions and product areas centrally affected by the introduction of the process. Thus, it is crucial for success that the team includes leading members of research & development, construction, design, distribution and marketing, in addition to product management. Before the project team takes on its actual tasks, a company-internal *workshop* can create awareness for the urgency for improvements and give interested company members the chance to participate.

4.2 Analysis

An essential task of the project team consists in *analyzing* current practices in the areas of product strategy development, product development, product program policy and product maintenance. This can be done by an internal study or an *analytical workshop*. The analytical workshop provides transparency and shared understanding for strengths and weak points of the ongoing formal and informal processes. However, there is the risk of participants influencing each other and of the status quo being only assessed vaguely due to time constraints. *Internal studies*, the second option of assessment, especially suit the purpose of soliciting input from different levels of hierarchy and experts with diverging viewpoints. At the operational level, a combined use of both methods is in order. For instance, weaknesses and potential for optimization can be ascertained by means of an internal study, to be verified and refined later by all respondents within a workshop. All *employees* affected by product-related planning and implementation should be included in the analysis. So a broad spectrum of perspectives on the processes and the challenges can be capture and also increases the assessment's degree of detail. All processes and activities assessed should be depicted graphically in process diagrams and extensively described verbally at the end of the analysis.

4.3 Process Specification

Building on the analysis of the company's status quo, the next step is the development of the company-specific process. An *abstract model* of the new FEI process has to be developed, using the model presented earlier as a blueprint. For each stage, its *purpose* and the *main activities* to meet this purpose have to be defined. Further precision and *adaptation* of the draft definitely requires the participation of affected company members and management to make sure that feedback from other company members involved in the process is included. Depending on the size of the company and the degree of employee participation, further rounds of feedback gathering can be planned. The process concept generated in this way has to be approved by management prior to the project team's further specifications (Cooper 2001). Once *approval* has been granted, it is the project team's responsibility to further *specify* the stages of the company-specific process model in terms of the organization and the instruments to be used.

Since most of the tasks in innovation and product management are interdisciplinary, there are many cross-sections between departments throughout the process phases. These cross sections have to be clearly defined and subsequently be complied with. Defining the process organization is closely connected to identifying an adequate embedding in the *organizational structure* of the company.

4.4 Process Implementation

Prior to the actual introduction of the company-specific process in integrated innovation and product management, all employees affected by the process, including those who have not been involved in its conceptualization up to this point, should be informed about its advantages. By means of *internal marketing strategies* (e.g. information sessions, intranet, brochures etc.), employees are to be informed on the impact of the new process in a comprehensive way. Once employees have been sensitized to the importance of the new process, training should convey the required *technical knowledge* as well as *personal knowledge*. Once a process has been introduced, it requires constant optimization and *adaptation* to change. Reasons often include the company's use of new technologies (e.g. the introduction of an engineering data management system) or the growth and development of the company itself (Andreasen 2005).

5 Checklist

To sum up, the following checklist may serve as a guideline for successfully implementing a holistic framework for the front end of innovation:

- Guarantee support and commitment of top management for implementing the new processes
- Comprehensively assess the micro and macro environment of the company
- Define a clear and transparent innovation strategy
- Communicate the utility of the developed framework for the front end of innovation within the company
- Ensure the use of synergies in respect to market and technological aspects
- Focus on comprehensive market orientation throughout the entire process
- Develop a commercialization concept for all innovation projects early on
- Install a performance measurement system and continuously control cost, quality and time of the projects. This ensures a goal-oriented budget planning.
- Form interdisciplinary teams at all stages and gates of the process
- Involve external stakeholders continuously during the entire process.