GENERIC MODEL OF THE EARLY PHASE OF AN INNOVATION PROCESS REGARDING DIFFERENT DEGREES OF PRODUCT NOVELTY

Robert Orawski, Jan Krollmann, Markus Mörtl und Udo Lindemann
Technische Universität München

ABSTRACT
Innovation processes are developed for various reasons, e.g. formalization, communication or controlling of development activities. A big variety of innovation processes and especially for its early phase can be found in literature directly correlating with the amount of different reasons for creating a new model. With the increasing number of models, the main benefit of formalization is obsolete: a comparative description how product design is carried out in a company. This papers deals with the early phase, the product planning and conceptual design of the innovation process. The literature lacks an overview of a generic model of the early phase. In order to deal with different degrees of product novelty, there need to be a flexible model in which a product planer is able to adjust his or her project of a new product flexibly depending on the determined degree of product revision. Therefore, the authors propose a merged model from a state of the art literature review with detailed income and outcome needed for each phase of the early planning process. It provides the opportunity to opt for three different degrees of product novelty: new product development, the adjustment or adaption design and the variation design.

Keywords: Innovation Process, Early Phase, Fuzzy Front-End, Degree of Product Novelty, Product Evolution

1 INTRODUCTION
Producing companies have to deal with increasing market difficulties as the market is more volatile than some years before. Strong competitors in a globalized world and changing customer needs in a fast evolving world are problems companies need to keep monitored and which result in shorter product lifecycle cycles of the own product portfolio. In order to stay in the market, companies have two possibilities, from the product life cycle view, for maintaining their market share. On the one side, there are strategies for extending the product life cycle which can be done by marketing activities or variant management. On the other side, there are kinds of products which need new constant development for keeping track with the technological evolution. Companies which are forced to introduce more and more short-living product generations have to deal with an increase in product development costs. Nevertheless, both strategies result in a change of the product generation. The difference will be the amount of time and effort which has to be assigned to a new product generation by the company. This has following reasons: Companies which have a long life cycle strategy need to develop their products more carefully as a new product needs to satisfy customer needs for a longer time period. This situation results in higher planning, designing, production, introduction and service costs. Further, companies which have a short life cycle strategy need to develop new products more frequently, which results in faster but more numerous development projects. The difference lies in the amount of time and effort which has to be put in the revision of existing products and their specifications. Innovative products, huge changes and new developments need to be seized differently by the company than small evolutionary changes or adaptive adjustments.
Looking at a standard product development process or innovation process which is described in more detail later in this paper, there is a stage where the specifications of a product concept is attained in which the work of a product planner is coming to an end and the designer gets the full responsibility for the development project. This paper will deal with the formalization of this period between the start of the development project and its hand-over to the designer by focusing on giving a solution to the problem of the different novelty levels a new product may be attributed to.

1.1 Motivation

It is the ambition of the paper to develop a product planning process which takes into account different levels of novelty of the product to-be-developed and thereby support product planers in a fast changing environment with a generic model of which can be flexibly adjusted to the determined degree of product revision. Looking at the literature, there are various propositions of how a product planning process can look like. All the examples have their own focus, their own specialization where they need to be applied and their own abstraction degree. However, one combination out of the mentioned differences between these descriptions of a development process is missing in literature. An integrated process model which provides an overall view of planning stages on an accurate abstraction level for all kinds of product novelty levels is not to be found in literature. In order to have a formalized planning process with which it is possible to compare planning processes between products with different novelty level and therefore different adequate planning stages, it is essential to examine similarities and differences of already given examples in literature. A possible way of achieving this point is by integrating existing product development processes into one generic one. Therewith, new product projects can be planned with one process model independently of the degree of product changes which the new product has to perform.

Analysis in industry, here exemplarily in a car manufacturing company, shows that existing processes in early planning are limited in their flexibility in adjusting to different levels in product novelty. In the particular case of the observed car manufacturer, a department responsible for defining and specifying requirements of a module of new car models to be developed struggled with the effort of implementing a new technology. In every day work, it was possible to reuse the department's standards for a list of requirements describing the regarded module. With every new car model just the values of the requirements were changed to adjust them according to company's strategy and close competitors' reference models. In other words, the level of product novelty was low in comparison with later described circumstances. In long-term adjustments of the requirement standards, the department checked the standards for actuality and sufficiency. In summary, the utilized process for requirement specification was a proven concept and successful in describing the module at hand and comprehensible for later development representatives. In today's challenge of the car manufacturer in implementing electrical components into formerly mechanical systems or modules, the observed department was struggling with the alignment of the traditional requirement standards and the new technology of electrical drives in automobiles. Known requirements were not sufficient anymore to describe the module which the department was responsible for. Utilized processes of specifying the module were not capable of give a support in specifying accurate requirements.

In this case, the department designed a new process for evolving new requirements in order to deal with the changed technology in the regarded module. This paper deals with the described problem of different innovation impacts in the early phase and how the author's approach improved the department's objectives in implementing a flexible process of dealing with the conflict of planning products with different novelty degree.

Nevertheless, many processes already exist in literature, so it was doubtful if an additional one could provide innovative information disregarding the results of other authors. Therefore, the presented developing process is derived from an extensive literature review which also provides an actual state of the art in this research area.

As a result of this research, we provide a formalized model of a planning process which will give product planners and researchers the opportunity to communicate and use one process model derived from existing process steps for their work with which new products with different novelty levels can be compared and discussed. This way, research and industry can maintain given procedures and evolve already implemented models of planning processes.

1.2 Questions

In order to achieve the research goal of creating a model of a generic product planning process independent of the degree of product novelty, the advantages and deficits of existing models have to be examined. This is important to achieve an overview of already known process models and to identify their specifics. Further, it is essential to classify existing models in order to compare advantages and disadvantages. The deficits can be omitted actively by this classification in the later stage of aggregation of existing models. So the following questions arise: What are the specifics of

existing developing process models? What are the criteria for distinguishing them? What are the deficits which have to be eliminated? How can they be categorized?
Further, it has to be analyzed if the formalization respectively the modeling language of each of the models is comparable to each other in order to aggregate them later into one model. So the question should be: How are different models to be connected to each other?
The last point addressed will be the aggregation of different models. The analyzed parts of various models have to be aligned accordingly to the overall goal of achieving a generic model and the chosen formalization. It has to be decided which parts of which model will be passed along to the generic model without changing or without leaving out important steps but with providing more information for a product planner. So the question is: Which parts of other product planning process have to be inherited?

1.3 Methods

In the course of creating a product planning process, we started with an extensive literature search. There we first concentrated on achieving an actual overview of complete innovation processes in order to get the whole picture. Beside other things, it was important to achieve an understanding of used synonyms and homonyms and further, system boundaries of the identified innovation processes. Hence, we had a good understanding of how to integrate more specific planning processes in the innovation process. Therefore, we were able to distinguish similarities and differences among the numerous planning processes.
After accomplishing an overview, we aggregated a process model out of the overview as an information source. There we concentrated on the mentioned criteria. The new process model had to be specific enough in various steps but still be able to explain the planning process of products with different a novelty level. Literature could not provide a definition for the level of product novelty. So, we use the term as the effort which a company has to make in order to bring a product into market.

2 LITERATURE REVIEW

During the literature review, it was essential to achieve a broad overview and understanding of the state of the art in innovation processes and particular in planning processes. Further, the various processes were compared and classified in categories which supported the creation of the generic model of the planning process in the next step.

2.1 Innovation processes

Today, companies have to face shorter development cycles and immense competitive pressure. To manage this situation there is a huge variety of process models for product development. They are used as a tool to standardize development activities like planning, designing and manufacturing products. Regarding the content of these models, they are based on the product lifecycle with its sequence of phases that a product passes through from the early beginning up to the recycling and disposal. In spite of the same focus to generate a new product by using approved operations, the numerous process models show differences. Variations occur due to the way the division of the necessary actions is set in different phases and the use of different notations for these phases.
In order to distinguish the innovation process from other process models like product development processes, it is necessary to take a look at the term innovation and its definition.
The term innovation is often used in an imprecise way by titling every new idea, new product or new technology innovation instead of invention. However an innovation is the introduction of novelties or the alteration of what is established by the introduction of new elements or forms [1]. The difference between an innovation and an invention is the successful implementation, introduction on the market and practical application of a new solution, a new product or new processes [2][3]. Based on this definition, the innovation process includes far more than just the generation of new product ideas. It includes all activities from the first idea in the early phase to the commercialization and market launch of the realized product.
A particular challenge of an innovative enterprise is handling the early phase of the innovation process. The uncertain situation about targets, the development effort, potentials and demands build the environment for far ranging decisions decisively affecting the successes of the enterprise.

2.2 The early phase of the innovation process

The early phase of the innovation process is a very important influence factor for the success of an innovative enterprise. The definition of the early phase with its beginning and its duration can vary along the literature, nevertheless many authors at least agree at the end of the early phase. At the end a Go-No-Go decision has to be made if the project should be pursued and financial resources are approved. The beginning of the early phase of an innovation process is not defined clearly. The reason for that is the large number of activators which are possibly leading to a project launch. Management decisions, market demands, technological potential or intern product ideas can set the first stone for an innovation process. Throughout this definition, the early phase activities take place in the first two sections of the innovation process, namely the product planning and the concept generation.

In the early phase of the innovation process nearly two thirds of the product properties are defined. Throughout these definitions, nearly 70% of the product costs which occur during the development process as well as the development time and the product quality are set during this phase [4]. The main problem is that the information level at this stage about market requirements, technical feasibility and necessary resources is very low which creates an uncertain situation. The outcome of decisions made at the beginning is very fuzzy. That is the reason why the early phase of the innovation process is also known as the 'fuzzy front end'.

Nevertheless, the early phase of the innovation process offers the possibility to implement various changes quick and without high expenses [5]. In the course of the innovation process, the uncertain situation of the early phase is reduced by the continuous increase of knowledge and information as well as the determent decisions. Though, changes at the product concept or the product idea are getting more and more extensive and expensive [6]. These characteristics of the early phase demands a process model for standardized operations and a creation of a solid base for the further development process.

2.3 Process models of the early phase

In literature different process models for the early phase of the innovation process can be found. Though, the models have different objectives and purposes. For this reason, it is necessary to classify the process models of the early stages.

Most of the process models, which can be found in literature, are activity models. This means that they list and describe the operations taking place in the early phase. Depending on the author, many varieties can be found in the numbers of sub-processes, the structure of the activity modules, the activities taking place in the sub processes as well as the intensity of activities during the different stages [7][8][9][10][14][17]. Nevertheless they all have in common that the basic function of the early phase is at least to generate the idea and to specify the product concept [12][13].

Table 1. Front end models (abridgement)

Author	Activities
Schwankl 2002 [6]	• Intensive analyse • Orientated solution search • Solution field enlargement • Verification • Definition of the complete solution
Herstatt 2007 [14]	• Idea generation and evaluation • Concept generation and product planning
Koen 2001 [17]	• Opportunity identification • Opportunity analysis • Idea generation • Idea selection • Concept development
Khurana & Rosenthal 1997 [8]	• Preliminary opportunity identification • Product concept • Feasibility and project planning

Cooper 1997 [7]	• Idea generation • Preliminary investigation • Detailed investigation
Spath 2000 [16]	• Planning product strategy • Product idea generation and selection • Product requirements investigation • Technical product conception • Developing marketing concept • Economical analysis

The different models offer particular features and intentions but they do not show inconsistencies to each other showing the conformity of the content of the early phase.
The different intentions of the process models can be detected by the sub-processes and their configuration. Compared to Schwankl [6] where the already given innovative idea launches the further detailed product definition, the process of the idea generation and selection is a central aspect of the fuzzy front process in the "New Concept Development Model" by Koen [17]. Schmelzer [11] and Khurana & Rosenthal [8] concentrate on the activities to enable the process of idea generation by generating and providing information about the market, technological opportunities or product and portfolio strategy. For them, this non-project specific information is necessary and very important to generate successful innovative products.
As well as at the beginning of the early phase, the models show differences at the intensity of operations at the end. The concept design and other activities like project planning are also considered. Some process models [6][7][15] put their focus on the product concept generation and development. On the other hand process models [8][11][12][16] consider project planning next to product concept development. This point of view gets closer to the application and actions taking place in innovation enterprises. Information about the profitability, feasibility of the project, project costs and project time need to be integrated and evaluated in the ultimate decision leading to a project launch.
Furthermore, differences between the process models can be found in the way the stages or sub-processes are connected. Cooper [7] connects the different activity modules by gates. At these gates the results are evaluated and decisions about the on-going of the project or iterative steps are made. Other models [14][17] have a serial character and incline to execute the activities step by step.
Generally speaking, the early phase of the innovation process is difficult to ascertain. The less structured and generally not sequential proceeding in an uncertain environment articulates demands on a process model. Existing process models do not provide an optimal universal solution to the different contents and objectives existing during the early phase. Nevertheless, the process models of the early phase and their individual qualities help to identify the requirements on a successful proceeding in the early phase.

2.3.1 Requirements on a generic process model of the early phase of the innovation process

The comparison of the different process models point out the necessary contents and properties a generic process model of the early phase should include. The idealized front-end model Figure 1 comprises the essential properties of a process model for the early phase.

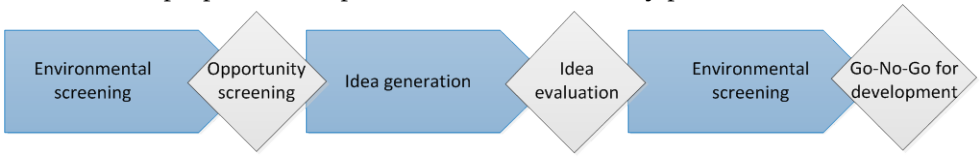

Figure 1. Idealized front-end model [10]

Because of the strong level of abstraction, this model can just be a guideline for a precise generic model which can be implemented in company's operations [10].
Most of the process models foci on one of the three major activities, but not on all. To provide a successful innovative product, it is necessary that the process model offers the possibility to pass through each stage developing an item with the highest quality possible.
Deficient environmental screenings for example restrain the chance to generate successful ideas which leads to products not matching the customers' demands.

The process model requires a configuration of all stages with activities and operations leading to ideal results. To evaluate these results, gates or milestones have to be integrated. In-between these milestones, iterative steps have to be taken if the results are not matching the demands.
At the very beginning, the impulse for an innovative enterprise can have various sources. They can be found in cross project decisions, specific market demands, potential technologies or project specific ideas. Therefore, it is necessary to include these sources as well as their analysis into the early phase. The different project triggers are a particular challenge and it is difficult to formulate a standardized and universal approach.

2.3.2 Novelty degrees and innovation type in the early phase

Regarding innovative projects, most of the people think about entirely new products. But considering the definition of innovation and the theories formed by innovation management, an innovation includes more than whole new products. As soon as a part, an element, a solution, a principle, a process or a design of a product or product parts is changed with a new input and established to the market, it is called innovation [14][18][19]. The early phase of an innovation process sets the fundaments for a product or any type of development object, it is necessary to consider the different novelty degrees and innovation types of a product.
Innovations can be found in different development types. In literature [3][20], three different types of development exist. There are the new product development, the adjustment or adaption design and the variation design. Depending on the type of development, different operations and phases have to be run through with more or less intensity in the early stages of the innovation process. A problematic fact is that it is impossible to draw a strict separation of these types. However, even in an adjustment construction, entirely new parts can be found requiring different activities and foci [3].
Next to this dimension of innovation types, the level of novelty of an innovation can be distinguished. First of all, it is necessary to recognize how new an innovation is to the company and to the market [21]. Management and the product strategy can set the wanted novelty level of a product at the market [18][22]. Followed by this, the level of novelty of a product concerning technology and knowledge for the company can be determined.
The classification of novelty levels of innovations is a difficult undertaking. In literature no common definition can be found. [23] The terms revolutionary and evolutionary innovations are frequently used describing the development of products with new technology and know-how or the enhancements of products with new applications.
The level of novelty and the innovation type, both are very important facts for the early phase. They define the steps and operations needed to develop a successful product concept.
The process models of the early phase, analyzed in chapter 2.3, do not take this fact separately into consideration. Due to the idealization of the models it is possible to use them for different kinds of novelty levels or innovation types. Certainly, considering shorter product lifecycles, increasing development activities and development costs it is necessary to design an efficient process model being able to satisfy the specific requirements towards development activities set by the industry. The demands towards fast and cost efficient development projects require an adequate proceeding.

2.4 Section summary

In the innovation process the early phase with its planning and concept design activities defines the success of an innovation venture. Therefore, it is necessary to support this section of the innovation process with a reliable and universal process model. The existing models show deviancies regarding the abstraction level of operative steps and integration of non-project-specific activities. Furthermore, the real procedures in an innovation process environment demand specific perspectives which cannot be found in the existing process models of the early phase. Therefore, new perspectives have to be included to provide a model being able to support the different development and innovation targets.

3 GENERIC MODEL OF THE EARLY PHASE

The creation of the generic model which provides an opportunity to classify new product projects is the main goal of this paper. After choosing an adequate modeling language for the process model, a generic model was created by choosing the important parts of existing planning processes. The result is a process model built from other models but providing a generic planning process with which it is possible to handle both new and evolutionary products.

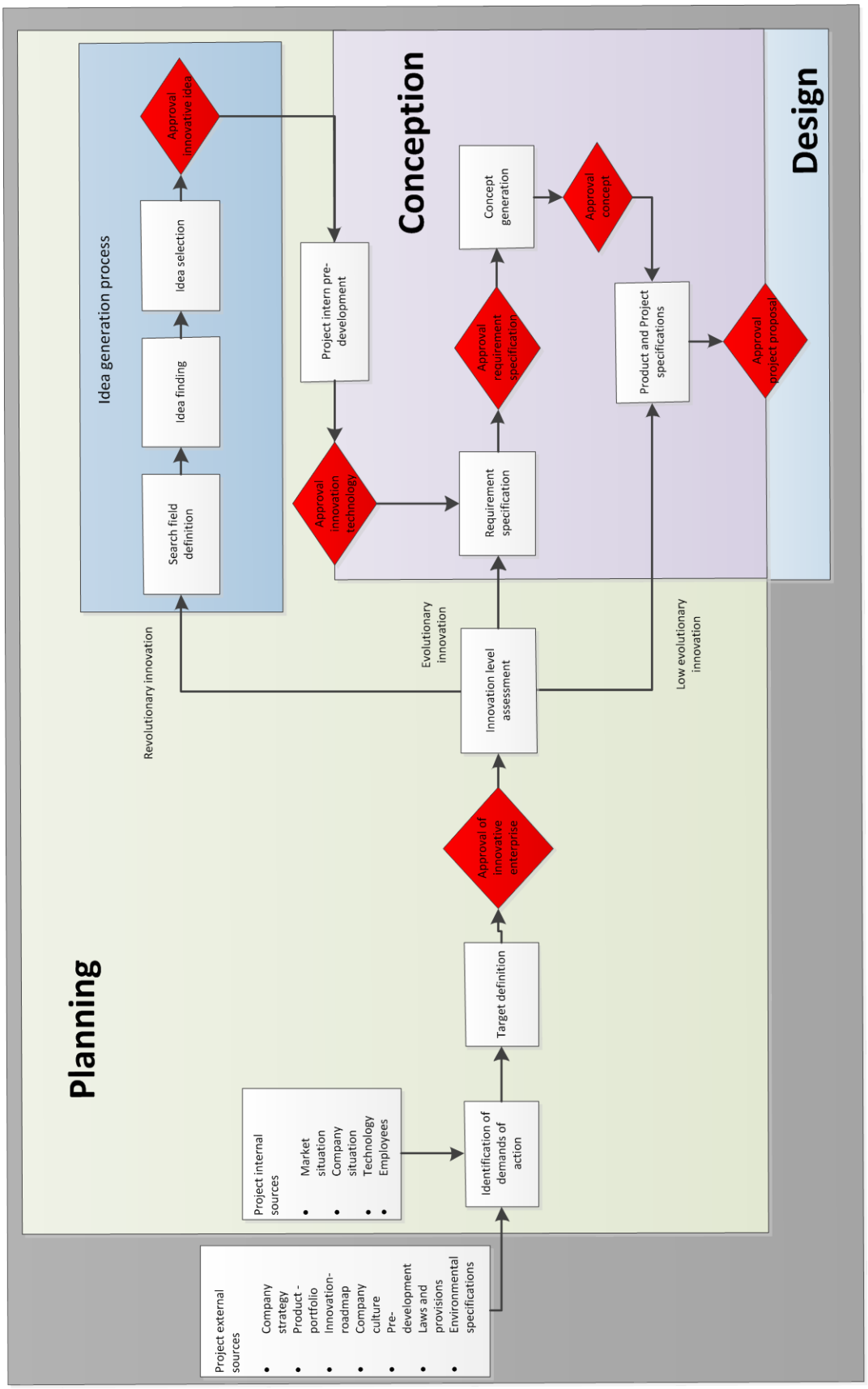

Figure 2. Generic process model of the early phase of the innovation process

3.1 Modeling

In order to have a systematic and a comprehensible way of modeling, the generic process model of the early phase was supported by a modeling language. Among other languages, we decided to use

flowcharts [24]. Flowcharts have the opportunity to represent processes with going into detail of focusing on their detailed phases. Further, it is possible to connect the phases by arrows. They were used to connect phases flexibly. Possible decision points were considered by stage gates which are also possible to display with flowcharts.

3.2 Objectives of the integrated generic process model of the early phase

At the early beginning of an innovative product project a company has to manage difficult situations. Next to the challenge to provide a precise target definition in a highly uncertain project surrounding, a consistent product concept has to be develop under various influences. To eliminate the "fuzzy" situation at the early beginning as well as to take an advantage of the influences, a generic process model for the early phase is needed.

Figure 2 shows a process models combining several existing models of the early phase and the innovation process.

The main reason for the development of the integrated generic process model of the early phase is that the existing models each concentrate on different important matters and operations of the early phase.

In the following process model, two main aspects have been integrated. The level of novelty as well as the development type of the product. Furthermore, the project character of an innovative product project, with its different information inputs and outputs, has been considered.

For the integration of the early phase and their operations, the model has been allocated to the steps of the innovation process and divided into planning activities and conception operations.

3.2.1 Planning stage

Concerning the project character, the internal process activities of the product project and its steps can be separated from the project external activities. The reason for that is the uncertain situation at the early beginning of an innovative enterprise. Various reasons are the trigger for an innovation project launch. The company's strategies, the product portfolio, the innovation roadmap or the product lifecycle management can deliver the demand for a new product project. These sources are often not taken into account. Especially when regarding new product development models, the first step is often the analysis of the customer demands as well as the company's opportunities [7]. However, these activities take place after a management decision has been made based on the strategy the company pursues to guarantee its future success. Therefore, it is necessary to consider these sources, which can be found in practical economic operations. Hence, the generic process model is embedded in the project external surrounding. The surrounding comprises the company's intern sources as well as the company's extern sources of influences on the innovation process. These influences are decisive about the basic requirements of the new product project and are on the one hand integrated in the identification of demands on action. On the other hand, these requirement sources accompany the whole innovation process. Therefore, they build the frame of the early phase process model.

The first step of the process model is the identification of the general demand whether a new product, an adjustment design or a variant construction is the object of the innovation process. By analyzing all sources of information, especially taking the market demands into account as well as the company's situation and possibilities, the company's strategy and the technological opportunities, the fuzzy situation starts to clear of. As a next decisive step, the target definition is set. Various researches propose that a detailed target definition supports the efficient innovation design and reduces development costs, time and uncertainties [5]. The result of this step is a verbalized target enriched with as much as quantified information about the innovation object as possible. At the end of the two first steps, a gate has to be passed where the project target is evaluated regarding defined criteria. The interdisciplinary decision appoints if the innovation process is continued, stopped or if iterative operations of the previous steps have to be arranged to match the required criteria [14]. All gates in the generic process model also serve as review points of the previous results to enhance the common level of knowledge and to increase the transparency of the innovation project.

The following step is decisive for the further ongoing of the process which depends on the level of novelty and construction type of the project target. The reasons are the novelty level and the development type of a product as well as different possibilities which have to be respected. First of all, innovative activities take place not only by developing new products. It was found out that just 10% of all development activities taking place in an engineering company are related to new products. The biggest part of development activities and efforts (85%), are found in adjustment, adaption and

variation constructions [3][20]. Therefore the generic process model provides three different proceeding paths tailored to match the diverse requirements of the construction type and levels of novelty. They consist of the paths for revolutionary innovations, for evolutionary innovations and for low evolutionary innovations.
At the beginning of this decision, there is an innovation assessment where the level of novelty and the construction type are analyzed and determined. First of all, depending on the construction types like new product development, adjustment construction or variation design, different operations have to be run through. For example, it is necessary, while dealing with a new product, to generate new product ideas matching the market and innovation target requirements. The fundament of a successful product can be found in a formalized idea generation process regarding the definition of the search field, the finding of existing or new ideas and the selection of the most promising ideas. However, this idea generation process is not exclusively done for new products. As explained, highly innovative ideas can also be found or demanded in adjustment or variation construction. Therefore, it is necessary to provide the idea generation process, exhibiting solutions and ideas with a high level of novelty in these cases as well. The decision if the idea generation process is run through, strongly depends on the technology and know-how level the company individually possesses. Hence, for the decision of the level novelty, it is important to identify if the innovation target is an innovation concerning the market or an innovation concerning the own company. For example, highly innovative products or adjustments for the customer can be design with established or known technologies a company already holds. Further, innovative ideas and enterprises can demand revolutionary technology and solutions need to be developed by a company before an application.
If this is the case, after the idea selection and approval, a pre-development step has to be passed in the generic process model. Especially revolutionary ideas and solutions have to be practically tested, verified and evaluated to reduce possible risks in the upcoming serial production [25]. Prototypes and simulations build the basis for the following approval of the innovation technology. The pre-development stage is located between the planning and conception phase of the innovation process. The reason for that are the activities taking place in this step. Identifying and selecting high risk technologies are planning activities. Further, the individual technologies have to be connected and formed to functional structures and technology components. The character of these operations creating a prototype is equal to the activities taking place in the concept phase and therefore need to be located in between.

3.2.3 Concept stage

If the innovation technology is approved, the next phase of the innovation process begins. The function of the concept phase is to provide a consistent product concept and prepare the launch of the development assignment.
Next to the path via the idea generation process, the innovation assessment step can demand innovation activities with less effort. That is the case when the innovation target is an evolutionary adjustment or adaption construction of an existent product with a lower level of novelty. Though, the company controls the demanded solutions and technologies and it is possible to precede the innovation process with the requirement specification.
This essential step builds the fundament of the conception phase. By collecting and analyzing new specific customers' requirements, it is possible to adapt the existing product matching the customers' demands [22].
Economic success of a product significantly results from the way the customers' demands are identified and included. Therefore, the translation of the customer demands into specific, quantified and technical product requirements is an important issue in this stage of the generic process model. At the following gate the requirements are approved concerning the requested quality, quantity and correctness.
Once requirements are set, the next process stage can be started. The concept generation delivers principle solutions for the different product functions and requirements. In literature process and operation models can be found including various methods supporting the conception design process [20][26].
This as every other step in the generic process model can just provide an optimal result if the sub-processes and activities offer an iterative character. Planning and developing activities are operations with a constant generation of information. Based on this information, decisions are made. The

consequences of the decisions provide necessary information on previous decisions. Using this iterative process, it is possible to reach optimal results. The advantage of the early phase is that due to the planning character, changes can be proceeded fast and without high expenses.
At the end of the process step, a complete product concept exists including all principle functions which are required by the identified demands.
Preparing and supporting the last step of the generic process model, the approval of the concept takes place. Here the concept is analyzed regarding the completeness of the implemented requirements. Due to the fact that the determination of the product concept has far ranging influence on the following development regarding costs, time and production, the approval is very important.
The last step of the early phase of the innovation process is the generation of product and project specification. Most of the existing process models of the early phase end with the generation of the product concept. Regarding the final approval and milestone during which the Go-No-Go decision about the innovation project has to be made, far more information about the project feasibility have to be considered and prepared. It is necessary for example to take economical aspects into account as well as the precise planning of resources. Decisions about in-house production depth, supply management, marketing concept and quality targets have to be prepared and measured. Another reason for the specification of the product and the project is that from this point on changes at the product get very time-consuming as well as expensive and need to be avoided. Based on the product and project specification documents, the decision about the launch of the innovation project is made.
Referring to the three possible paths through the generic process model, this step can also be reached without passing through the requirement specification and the concept generation. Dependent on the result of the innovation level assessment, these steps and operations can be skipped or at least run through faster. The reason for that can be found at the development type. Variation constructions or product generation adjustments can demand small changes. These product changes are independent of the determinations of the planning or conception phase of the innovation process. They effect issues like design or production and make no demands on a modification of the product concept.
The generic process model differs from existing process model of the early phase of the innovation process. Nevertheless, it is not inconsistent to the different models. The intention to combine the different objectives and enlarge them with the issue of the different innovation types builds the basic idea for the new generic process model.

3.3 Section Summary

To develop a successful innovative product, it is necessary to support the uncertain operations at the early phase with a process model. The existing process models show deficits regarding the different innovation types as well as the focus and intensity of the operation during the early phase. The intention of the presented generic process model of the early phase of the innovation process is to allow an easy implementation independent of the level of novelty or development type of the innovation project. Due to the fact that the novelty level of a product is very important to the proceeding, the presented generic planning model includes different approaches. The target is to provide an efficient and object-specific process model to optimize development projects regarding time and costs.

4 CONCLUSION AND OUTLOOK

4.1 Discussion

The proposed process model for product planning supports companies in handling various kinds of revolutionary changes in boundary conditions without disregarding evolutionary evolvement of the company’s product portfolio. So, in nowadays’ fast changing environment, companies will have the opportunity to implement a process with which it is possible to flexibly react on market changes like technology leaps and still to perform the every days’ work with reasonable efficiency. The actual situation in the automotive industry shows how this flexibility is needed. Specifications for cars evolved for several years. Groups of engineers have validated the correctness of these specifications in several product projects and regarded them as acceptable. This also applies for the combustion engine. But with the forced change towards an electrical power track, these evolved specifications became obsolete. So, work process in the development departments had to be changed. The level of novelty

pressed the planning departments to abandon their normal work trail and begin with their work at a whole new abstraction level of the needed requirements.
Regarding the observed department which had the responsibility in designing the specifications for a whole new module, the authors combined the proposed innovation process with the department's process of designing specifications. In an iterative modularized process, different levels of product novelty were considered. This integrated process was able to deal with projects of evolving improvements and radical innovations.
In order to handle this kind of situations, we propose the generic planning process regarding different levels of product novelty. An important issue was the use and credit for already existing process models in order to support the model's feasibility in two ways. On the one hand, avoiding the creation of new process steps was necessary to reduce the amount of effort needed to create a new process model. On the other hand, the proposed planning process can be implemented easily in existing new product management structures in companies as the generic process model of the early phase rather concentrates on connecting existing phases out of different processes than introducing new procedures.

4.2 Further Research

A further task of supporting the feasibility of the generic process model should be a method concentrating on measuring the degree of specification change that could be anticipated in the new product project. This way, it would be possible to distinguish the effort needed in each step of the early phase of the innovation process in order to generate their essential output. If a planning department would have an opportunity to assess, for example, the required effort to scan new environmental regulations due to a technology change, it would have a positive impact on the efficiency on this work step. Generally, a method for the assessment of the new product project and its classification which path through the planning process should be taken would be of great benefit for a company.

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Contact: Robert Orawski
Technische Universität München
Institute of Product Development
Boltzmannstraße 15
85748 Garching bei München
Germany
Tel: Int +49 289 15135
Fax: Int +49 289 15144
Email: robert.orawski@pe.mw.tum.de
URL: http://www.pe.mw.tum.de

Robert Orawski graduated as industrial engineer at University of Paderborn, Germany, in 2008. He focused on innovation management during his studies. He now works as scientific associate at the Institute of Product Development at the Technische Universität München, Germany. His research field is in synchronizing requirements engineering and innovation process with technology innovation.

Jan Krollmann is a student at Technische Universität München, Germany with a major in mechanical engineering. He focuses on systematical product development. His semester thesis dealt with requirement engineering processes during the early phase of an innovation process.

Markus Mörtl studied Mechanical Engineering at the Technische Universitaet Muenchen. After finishing his Doctor Thesis 2002 he worked in Industry. Since 2005 he is Postdoctoral Research Assistant at the Institute of Product Development (TUM), Member of Committee of Experts at VDI, and leader of the VDI-Seminar “Cost Management for Product Development”.

Udo Lindemann is a full professor at the Technische Universität München, Germany, and has been the head of the Institute of Product Development since 1995, having published several books and papers on engineering design. He is committed in multiple institutions, among others as Vice

President of the Design Society and as an active member of the German Academy of Science and Engineering design.