1 A METHOD TO IDENTIFY RELEVANT STAKEHOLDERS TO BE INTEGRATED IN NEW PRODUCT DEVELOPMENT PROCESSES

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The core idea of stakeholder analysis aims on identification of active participants and passive attendants. It became a powerful means to explore social networks. The adaptation of this method in order to support the NPD process by customer integration demands a central paradigm in order to proceed systematically. Being aware of how products are applied by customers is considered one of the key issues to make products fit customers' needs. Thus the application process bridges the customer view and the NPD process. The authors present an application based approach to span a process network. Further analysis discloses decisive stakeholders to enrich the NPD process. A case study illustrates the method. Identification of decisive stakeholders in product application supports weighting of requirements in early stages of the NPD process. Characteristics of decisive stakeholders provide a means to further integration in the NPD process.

Keywords: Stakeholder analysis, innovation networks, new product development (NPD) process.

1. INTRODUCTION

Being aware of how products are applied by customers is considered one of the key issues to make products fit customers' needs. The research project AKINET (active customer integration in innovation networks) aims on questioning customers "how" a product should be done after the demand was identified ("what should be done").

The cooperative project consisting of both academic and industrial partners funded by the German federal government focuses on treating the customer as an active partner in order to integrate the customer in early stages of the new product development (NPD) process systematically. Methods support the systematic integration of customers' knowledge, experience, and creative potential to enrich the generation of innovations. Therefore both guidelines for setting up processes for active customer integration and guidelines to be applied in innovation management are to be composed and further improved.

The university analyzes the structure and dynamics of innovation networks in general based on several interviews to be conducted. A model comprising the customer-integration in innovation networks and a collection of requirements describing the method application enrich a generic process model for innovation. A convention enables the transfer of research results to academic and industrial expert audience.

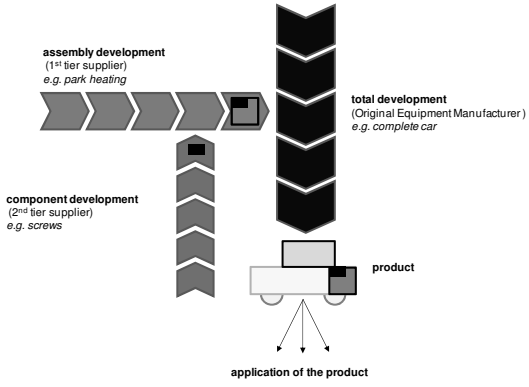

Figure 1. Interlinked process network.

Technical products often consist of various components. A car as an example for a complex product consists of several thousand parts. Clustering approaches and methods keep the development process capable. Assemblies aggregate particular components and are merged to the total product. Considering a complete car, the park heating poses a complete unit and therefore development can be carried out by a supplier. The supplier may integrate standard components such as screws from the second tier in order to compose the heating module together with specialized components of his own. Users may apply the total product to fulfill their needs. A process network comprising interlinking processes composes these particular processes to a whole (see Figure 1). Choosing a proper level of detail as well as a reasonable point of view when defining the application determines the significance of this concept.

Putting emphasis on early stages in product development demands identification of decisive requirements facing the NPD process. Identification and clustering the sources of requirements enables to query decisive requirements in early stages and the integration of decisive customers systematically in the NPD process later on.

Starting point for deriving the innovation network systematically is to identify the stakeholder network located around one application. After that exploration of development processes leading to the product to fulfill the application takes place.

Providing a methodical framework for active customer integration to the NPD process will enable small and middle enterprises (sme) to strengthen their competitiveness by providing products closer to customers' needs. The first step towards this goal is the identification of reasonable and decisive customers. Therefore the authors present a method of spanning a stakeholder network around an application process of a product in this paper.

Section 2 provides background information about existing approaches of clustering stakeholders and several definitions within the research project. Section 3 contains the method of exploring the stakeholder network embracing the application process systematically. Section 4 details a case study and exemplifies gathering the data. Section 5 presents the data interpretation. Section 6 summarizes the outcome of the work.

2. BACKGROUND

This section contains definitions to be used as follows and details the approach of establishing process networks. It highlights the terms "customer definition", "innovation networks", and "stakeholder analysis". It also provides an overview of existing approaches of clustering stakeholders.

According to ISO 8402:1994 a customer is defined the recipient of a product provided by the supplier. In a contractual situation the term customer stands for purchaser. In general the customer may be the ultimate customer, user, beneficiary or purchaser for example. A customer can be either distinguished

to be external or internal to the organization. ISO/CD1 9000:1998 (that was to replace ISO 8402) bases the definition of the term customer on being the recipient of a product without specifying the origin of the product anymore. This understanding goes along with colloquial American English, where the term customer is used for a person who is buying a product. Contrary a client is receiving a service. ISO 9001 defines the customer to be "*anyone who receives products or services from a supplier. A customer can be either external or internal to the supplier organization.*" Thus the understanding of the term embraces recipients of products and services provided by a supplier. The boundary of the supplier organization determines the characteristics of a customer to be internal or external. The research project AKINET (active customer integration in innovation networks) focuses on the customer definition provided by ISO 9001. The main goal is to support the NPD-process, thus it is considered reasonable to enrich the definition of customers to emphasize this process view by also considering the backwards view of the value chain, such as the supplier and the supplier's supplier. This view also relates to the point of view overlooking the process or interlinked processes.

An innovation network focuses on commercialization of innovations and is considered a "powerful tool to foster innovation".[1] DeBresson & Amesse[2] state, based on analysis of economic and technological history, that "clusters of innovations associated with networks of innovative firms have been the general rule." Fischer[3] suggests a definition of innovation networks based on network characteristics provided by Tijssen[4] "as an evolving mutual dependency system based on resource relationships in that their systematic character is the outcome of interactions, processes, procedures and institutionalization. Activities within such a network involve the creation, combination, exchange, transformation, absorption and exploitation of resources within a wide range of formal and informal relationships." An innovation network consists of a complex tracery of plural co-operation partners, that agree upon a willful, lasting, distributed and interactive cooperation at innovating.[5] The relations between these cooperation partners consist of either general economic links, such as channels for goods and services deliveries, or specialized ones. Transfer of information about technological opportunities or about customer needs takes place in specialized technology links.[6] Duschek[7] discusses the term innovation networks also from a sociologic point of view as structure to coordinate innovation, in that inter-organizational and organizational processes for interchange and communication, focused on technical parameters and knowledge, cause each other and support each other. Various contributions of innovation are interconnected and result in an innovative overall performance.

The stakeholder concept provides a key to analyze and reason about business and society relationships.[8] As the stakeholder approach emerged it attempted to be a framework for management supporting managerial strategic decision making.[9] Among others Svendsen[10] describes "how companies build long-term, mutually beneficial, collaborative stakeholder relationships". As the research project funds on exploration of innovation processes a brief summary introduces the stakeholder concept. Generally a stake represents either an interest in or a share in an undertaking or a claim.[8] The latter one comprises a demand for something due or believed to be due. Hence an interest, a right or ownership stands for several types of stakes. Additionally a stakeholder has one or more of these kinds of stakes. The stakeholder is defined as an individual or a group in the organization or a company ([8,9]).

Roden *et al.*[11] describe a process-stakeholder analysis of B2B industry standardization. They set up a research framework in order to analyze and describe this process comprising the (1) tasks performed, describing the (2) stakes and (3) roles that participants in the process may adopt. For the special case of an IT standardization process de Vries *et al.*[12] summarize nine search directions for systematical identification and classification of stakeholders: (1) product chain, (2) end users and related organizations, (3) designers, (4) physical system, (5) inspection agencies, (6) regulators, (7) research and consultancy, (8) education, and (9) representative organizations. Roden *et al.*[11] make use of a classification of three critical attributes presented by Mitchell *et al.*[13] that determine a stakeholder: power, legitimacy, and urgency. Schmeer[14] summarizes how to use the information gathered in stakeholder analysis. Identification of stakeholder enables

- Power Leadership analysis,
- Analysis of stakeholder's position (supporting, neutral, or opposing),

- Clustering knowledge levels,
- and key alliances of stakeholders.

Cross-referencing these aspects enables deriving strategies and to take action. It can provide input to further analysis, to developing action plans or to support a consensus-building process.

DeBresson & Hu[15] describe an approach to yield information between suppliers and users based on survey replies. They perform mapping innovative activity in the economy by making use of their innovative interaction matrices at the level of supplier and user industries. Innovation interaction matrices reveal "the breeding grounds of change in the economy." The sources of growths unhide and the impulses to the rest of the economy appear based on surveys directly or derived from further estimation.

Focusing innovation networks applying stakeholder concept the term customer as *anyone who receives products or services from a supplier* (ISO 9001) represents a stakeholder. The supplier itself is another stakeholder. Therefore the research project AKINET focuses on exploring innovation networks by identifying particular processes, stakeholder and their interrelations in order to support the NPD process.

Nevertheless the dynamic character of an innovation process and especially the highly interfering character of relations between stakeholders is not covered completely by stakeholder analysis and the presented approaches of clustering stakeholder. As follows the authors present a method to capture stakeholders of a product application process to derive an innovation network systematically from application to innovation in the NPD process.

3. METHOD

"Swimming upriver" the innovation network from the application process to the NPD-process in order to support innovation drives the method forward. Within this paper the authors take the necessity developing a product fitting a specific application for granted.

Being aware of how products are applied by customers is considered one of the key issues to make products fit customers' needs. Thus the product application is considered the starting point for composing an innovation network. The second step is to analyze innovation processes that result in products to be used in this application process to fulfill customers' needs. These innovation processes may be interlinked together and may be distinguished e.g. by considering product specific attributes such as parts and assemblies within the product structure. This sounds reasonable in the case of product development where added value is generated e.g. by production.

The application process itself is considered a sub-process relating to product life cycle. In order to detect decisive influences that affect the product application itself it comprises process steps that lead to or demand the application of the product partly, that is as follows called extended application process. Considering the product life cycle the product itself may either fit this application perfectly, or in case of abuse does not.

Stakeholders are to be identified systematically that determine the application decisively. An approach comprising a combined interview and documentation methods fits the requirements and conditions in application processes perfectly. In general the assumption is taken that the interviewee has only limited view of the application process. When only focusing on e.g. applying tools, one can not reason about the decisions that cause the use of this special tool. Considering the extended application process supports understanding the causal chains that directly affect the application process. This knowledge provides beneficial input to NPD processes later on, that concentrate on fulfilling this application properly. Even a new kind of application can be identified, that fulfills e.g. the architects needs better affecting time, costs, effort and complexity. The method is structured as follows:

1) Set up a hypothesized extended application process
2) Determine interviewees to cover the hypothesized process step
3) Perform interviews

- to get to know the process and stakeholders
- validate the hypothesized process steps
- verify the results

In general the assumption is taken that manufacturers know where their products are applied. Experts concerning the application may also provide hints to set up the hypothesized extended application process. This hypothesis is used to determine first interview partners that cover the whole process in order to validate the hypothesis. This validation goes along with already retrieving information about the stakeholders of the application process, such as the tasks performed, describing the stakes (power, legitimacy, and urgency), and roles (compare[11,13]). This information is summarized in a table of characteristics together with the motivation and experiences of acting in the process. Moreover the activity of stakeholders represents the degree of participation in the application process. Directly involved stakeholders affect a process stage, engaged stakeholders are influenced by other stakeholders.

During the interviews a guideline provides a list of several topics concerning the process and interactions to be discussed. It is assumed that the interviewee is able to inform about the application process in detail where he or she is engaged directly. Asking beyond this process stage information may become more unclear and diffuse. In order to encourage the interviewee to tell about all he or she knows a visualization method activates the interviewee and summarizes the interview results directly. A process whiteboard enables the documentation of processes and stakeholder interactions with either process steps and among each other clearly. Recapitalization of the interviewee's statements and the possibility to point out parts of the application network that are not yet discussed raise the overall performance of the interview. Additionally interviews are tape-recorded, transcribed, coded and analyzed.

Each interviewee covers a limited range of the process, thus it is necessary to compose the interview results to derive the application process network finally. An iterative approach of alternating interviews and composition assures consistency. Each interviewee can rate the application network in progress. Therefore it seems reasonable to compose the application process as a whole.

The real extended application process network results: (1) comprising the process, (2) stakeholders including their characteristics, (3) process dependant stakeholder involvement, and (4) additionally technical requirements characterizing the application. This information enables to set up Multiple Domain Matrices (MDM) as described by Maurer[16] to be applied for further analysis and standardization of the results.

4. RESULT

A case study highlights the capability of the presented method. An application network is identified and enables to provide beneficial input to the NPD process. The cooperation with a major industrial partner enabled to carry out the detailed case study. Thus the information provided in this paper is rather generic but it demonstrates the proceeding colorfully.

The starting point of the case study is an application that leads to the generation of a fixed asset. Due to experience and touch to market the industrial partner recognized a lack of satisfying the application by existing products. The management decided to overcome the limitations of the existing approaches by innovating. The company's experts wanted to question completely the existing products and solutions to fulfill this application. The existing products were considered not be appropriate completely to fulfill the application, that is why potential for new innovative products was identified. An extended application process represented by an enveloping process was set up, to understand the causal chain that determines the emergence and circumstances of this application (see Figure 2).

A hypothesized extended process chain was set up to identify first interview partners for validating the hypothesis. After rough planning of the construction a detailed planning stage follows. Stress analysis contains calculation and dimensioning. The purchase of the plans, documentation and calculations is considered a process step due to the required effort. After that the construction work takes place. The particular application of power tools is performed in the construction stage, but determined in earlier stages. The interviewed experts were located at the beginning, middle and end of and confirmed the estimated process. Additional interviews complemented the application process network.

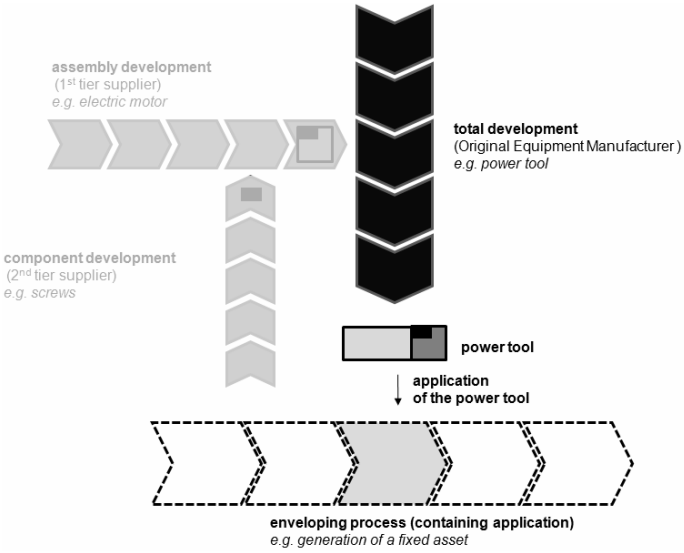

Figure 2. Exploring the process enveloping an application.

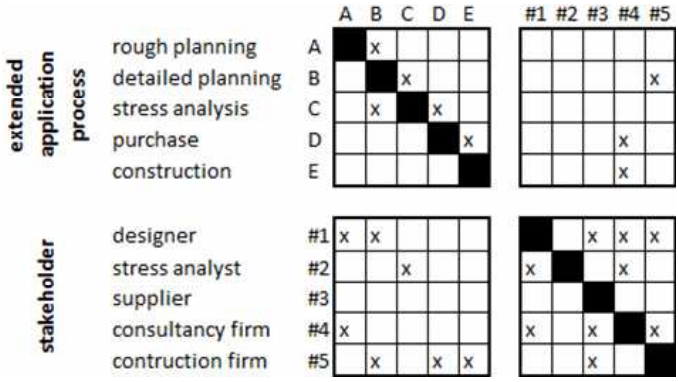

Figure 3. Case study construction of fixed asset — overall matrix.

Figure 3 illustrates the condensed results focusing on process steps, directly involved and engaged stakeholders. A MDM contains process steps and stakeholders as domains. Letters represent process steps, numbers stand for stakeholders.

The MDM contains a snapshot of the process enveloping the application of power tools in generation of a fixed asset. The order of process steps, as well as the main stakeholders driving process steps, stakeholder influencing each other and process steps affecting stakeholders characterizes the process.

5. DISCUSSION AND INTERPRETATION

Based on the process information gathered by the interviews time dependant interactions enable the further analysis of the process enveloping the application. Interrelations between particular process steps refer to the sequence and iterations. The MDM also includes Stakeholder engagement in particular process steps. Time dependent interrelations among stakeholders are not yet represented satisfactory. These enable to identify decisive stakeholders, that determine particular process steps.

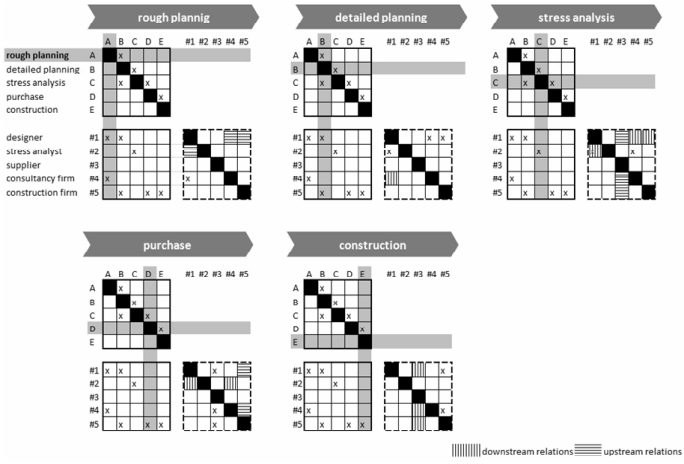

Figure 3. Case study construction of a fixed asset — detailed matrices.

Assuming the time line refers to the sequence of process steps, the overall matrix is unfold in detailed matrices (see Figure 4). The MDM matrix containing the domains stakeholder and process steps visualizes the changing influence of particular stakeholders. Moreover the time dependant character becomes visible. Stakeholders affecting others and upstream and downstream characteristics add another dimension to the process of the process. Analysis identifies stakeholders that influence other stakeholders in subsequently following process steps. Stakeholders' characteristics of activity enable to identify degrees of passivity and activity, interaction loops and thus dynamics of stakeholder engagement.

These characteristics enable the weighting of requirements to support the NPD process itself. Thus strategies enable to integrate the collected data precisely into the NPD process. Based on activity and range of participation stakeholders that are to be integrated in the NPD process are suggested. Moreover entry gates to place products addressing the key stakeholders in the process enveloping occur. Products fitting the application from an embracing point of view result. The stakeholders' characteristics also enable the integration of stakeholders to specific steps of the NPD process, such as plan goal, analyze goal, structure tasks, generate solution ideas, assess properties, make decisions, and ensure goals achieved as described by Lindemann.[17] There strategic phases precede creative and decision taking phases. This process representation by several domains, such as process steps and stakeholders, supports further analysis performed numerically. The rather abstract and formalized representation raises the comparability and compatibility among several projects.

6. CONCLUSION

The model of a process representation needs to be proofed and confirmed by further case studies. Time dependent interrelations are the key to identify decisive stakeholders. Stakeholder analysis is a powerful tool, but needs to be adapted in order to support the NPD process systematically. Setting up the extended application process including the process determining the application furthers the understanding of the product application. In order to derive the processes enveloping an application a process hypothesis needs to be generated and validated "on the fly". The assembly of an application centered stakeholder network can be supported by the described method systematically and leads to an almost complete network. This enables to enrich the NPD process. Moreover strategies enable to integrate the collected data and the experience and requirements of decisive stakeholders precisely into the NPD process.

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